SCHOOL-COMMUNITY RELATIONS, SOCIAL CAPITAL AND CHILDREN'S WALKING TO SCHOOL BEHAVIORS

A Dissertation

by

HYUNG JIN KIM

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2011

Major Subject: Urban and Regional Science

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ABSTRACT

School-Community Relations, Social Capital and Children's Walking to School Behaviors. (December 2011)

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In spite of increasing interests in the relationship between neighborhood environments and children's walking-to-school behaviors, few studies have examined the dynamic nature of school-community relationships from physical and social perspectives. Questions such as how centrally the school is located within the larger community, and how connected or accessible the school is to the surrounding communities, will have significant implications for children's walking to school and physical activity behaviors and also for the community's social capital.

The primary aims of this study are: (a) to assess the association between school-community relations and social capital among parents of school children; (b) to assess the relationship between school-community relations and walking-to-school behaviors among school children; and (c) to examine the mediating effects of social capital on the relationship of (b).

This cross-sectional study focuses on children and parents from 19 elementary schools in the Austin Independent School District (AISD) in Austin, Texas, utilizing the parental Safe Routes to School (SRTS) survey and conducting a follow-up Parental

Social Capital survey to gather additional in-depth data on social capital. Also objective measurements are performed to assess school-community relations and physical environments using the spatial centrality index and Geographical Information System (GIS) network analysis at/around schools and surrounding communities. Data analyses are conducted based at the school/community-level and the individual-level (large full data and small sub-group data) separately by using ANOVAs, bivariate statistical analysis and multivariate statistical models.

Overall findings of this study show that: (a) neighborhood schools have more students walking to school and a higher centrality of the school than non-neighborhood schools; (b) differences in social capital between neighborhood schools and non-neighborhood schools are not significant or are only marginally significantly; (c) two social capital variables, "volunteerism" and "social cohesion" are correlated with children's walking-to-school behaviors but no significant mediating effect is found for social capital in the association between school-community relations and children's walking-to-school behaviors; and (d) "volunteerism" is shown to be positively correlated with "perceived centrality" but negatively associated with all objective centrality measures. The other social capital variable of "social cohesion" has a positive correlation with one of the objective centrality measures, "closeness centrality".

Findings of this study may contribute to research exploring the dynamics of school-community relations with socio-spatial perspectives, and also bring attention to the policy makers for school siting in the large community context and evidence-based knowledge promoting healthy community design.

DEDICATION

To my parents and Sumin, with love and gratitude

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Thanks first to God for unfailing love guiding me all through my life. To my parents, my wife, Sumin, and my daughter, Jiyeon, thank you for your love, patience, and the sacrifices you have all made. I will be forever grateful. Thanks also go to members of the Korean Church of A&M for their true brotherhood.

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NOMENCLATURE

AISD	Austin Independent School District
GIS	Geographic Information Systems
SRTS	Safe Routes to School
AEIS	Academic Excellence Indicator System, Texas Education Agency

TABLE OF CONTENTS

Page

Page

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

Page

Page

1. INTRODUCTION

> Schools represent long-lived and spatially fixed infrastructure investments. Decisions about where to locate new schools influence the travel patterns of students and parents in the short run and the spatial development of the community in the long run.
>
> - McDonald, 2010

1.1 BACKGROUND

Walking-to-school is an important part of children's daily physical activity (Alexander et al., 2005, Cooper et al., 2005, Fulton et al., 2005). From 1969 to 2009 in the US, the percentage of students walking or bicycling to school declined from 41% to 12.7% (McDonald et al., 2011). Meanwhile, childhood obesity rates among 6- to11-year-olds have quadrupled over the last four decades (Ogden et al., 2002). With increasing concerns about childhood obesity and recognition of environmental and safety barriers to walking-to-school, growing efforts are being made to identify effective environmental and policy strategies to promote children's physical activity (Dannenberg et al., 2003; Davison and Lawson, 2006; Jackson, 2003). However, the nature of environment-walking to school relationships depends on the specific environmental and social settings. Thus, tailored intervention strategies for interlocking them are needed. Recent work on school transportation has identified traffic and crime safety, school location and policies, and home-to-school route characteristics to be among the key environmental correlates of school travel mode choice (Chaudhuri, 1996; Sallis et al., 2001; Zhu and Lee, 2008b).

This dissertation follows the style of Health & Place.

The dynamic nature of school-community relationships is one of the crucial parameters of children's walking-to-school. In spite of few efforts to identify their associations, walking-to-school has often been regarded as a determinant of defining a neighborhood school which is characterized as having a small-, community centered- and walkable-school attendance area (McDonald, 2010; Sharp, 2008).

Questions such as how centrally the school is located within the larger community, and how connected or accessible the school is to the surrounding communities, will have significant implications for children's walking-to-school behavior. Also importantly, schools serve as places for recreational and social activities and/or function as the physical and perceived centers of the larger neighborhood, thereby contributing to enhance social capital among members of the community. However, these important questions remain largely unanswered.

In the meantime, across communities in the US, student enrollment has increased substantially (Vincent, 2006; Ewing et al., 2004) and new school construction has also increased, reaching an all-time high in 2004 (Vincent, 2006). New school constructions along with suburban developments have outnumbered renovation projects in inner cities due to policies incentivizing new schools (Beaumont and Pianca, 2002). Since 2002, policy makers have started to reemphasize the value of maintaining small neighborhood schools which tend to be more supportive of walking-to-school and contribute to social cohesion of the community (Beaumont and Pianca, 2002; Gurwitt, 2004; Passmore, 2002). Also, planning researchers have pointed to the problems related to "school and

city disconnect" and the need to consider public schools as part of public infrastructure (Vincent, 2006; Ewing et al., 2004) (Figure 1).

However, in spite of an increased emphasis on the disconnected school-community along with school construction and school siting by policy makers and practitioners, few studies have attempted to examine if small neighborhood schools are better than non-neighborhood schools in a large community in promoting children's walking-to-school and enhancing a community's social capital. There is still much to be learned to bridge the knowledge gaps between the school-community's physical and perceived relations, the social capital of community members, and its dynamic impact on children's walking-to-school behaviors and physical activity.

Zavala elementary school		McBee elementary school
1936	Year of Establishment	2000
About 2 miles	From Downtown	About 10 miles
460	Total Enrollment	820
$29,350	Median Income	$37,430
50.42%	% Walking to School	**30.92%**

Data Source: Zhu, 2009

Figure 1

Neighborhood School vs. Non-neighborhood School (Austin, TX)

1.2 SIGNIFICANCE AND KNOWLEDGE GAP

School-community relations should be considered with respect to both physical and social environmental dimensions because public schools serve as important public service facilities and essential social infrastructure of the community. From social and educational perspectives, a large number of studies have identified schools as community centers important to socially structured school-community relations (Litwak and Meyer, 1974; Haynes and Comer, 1996; Popkewitz, 1998; Osterman, 2000; Driscoll, 2001). Despite the recognition that such bilateral, social and physical approaches to school-community relations are important previous studies on school-community relations have not addressed these physical and social aspects comprehensively.

Further, studies on the relationships between physical environments and physical activity often ignore the mediating effect of social environments. However, the significant roles of both social and physical factors on health behaviors have been widely recognized by researchers and professionals in multiple disciplines (McNeill et al., 2006; Addy et al., 2004; Cao et al., 2006; Frank and Engelke, 2005; Franzini et al., 2009). School-community relations are important yet unexplored areas of research that may shed new light on creating socially and physically connected and accessible communities that promote physical activity among youth.

Although it is difficult to measure children's sociality in the community, parent's social indicators can tell how they socially relate with school and community because parents are their social references and teachers at home (Maffeis et al., 1998; Sallis et al., 2000; Davison et al., 2003). Studies have introduced "social capital" as an indicator of

social relations of school and community since Comer's School Development Program (SDP) in 1980 (Comer, 1980; Kretzmann and McKnight, 1993; Kretzmann and McKnight, 1996; Driscoll and Kerchner, 1999). Among the varying definitions of social capital, this study uses its broad definition as "integrations of social trust, norms, and networks that facilitate certain actions of individuals who are within the community" based on existing scientific approaches (Coleman, 1990; Putnam, 1995; Putnam, 2001; Farr, 2004). Evidence in community-level studies supports social capital's positive effect on human health as measured by self-reported health status (Chavez et al., 2004; Wen et al., 2003; Subramanian et al., 2002), mortality (Kawachi et al., 1997; Lochner et al., 2003; Skrabski et al., 2003; Kennelly et al., 2003), and psychological depression (Pollack and von dem Knesebeck, 2004; Veenstra et al., 2005; Ziersch et al., 2005). Evidence on physical activity is weak but growing (Maffeis et al., 1998; Franzini et al., 2005; McDonald, 2007). Also, an increasing number of studies have examined the associations between physical environments and social capital (Leyden, 2003; Stedman, 2003; Giles-Corti and Donovan, 2003); physical activity studies have suggested social capital as an environmental mediator of physical activity as well (King et al., 2002; Sallis et al., 2006).

Thus, this study bridges the knowledge gaps by:

- Re-highlighting the school-community relationship through social and physical perspectives.
- Exploring the association of school-community relations and children's walking to school behaviors.

- Using parental social capital to measure a community's sociality as a way of promoting children's walking-to-school and physical activity.

1.3 RESEARCH QUESTIONS

Given the understanding of study significance, major topics and theoretical frameworks, this study seeks to answer five primary questions:

- Are school-community relations associated with social capital among parents of children in the community?
- Are school-community relations associated with children's walking-to-school behaviors?
- Is social capital a mediator in the relationship between school-community relations and children's walking-to-school behaviors?
- Are physical (or spatial) school-community relation measures correlated with measures of perceived (or social) school-community relations?
- Do the school-community relation measures perform differently between a small neighborhood school-community and a large non-neighborhood school-community?

The sections that follow will address each of these questions.

1.4 STRUCTURE OF DISSERTATION

This dissertation consists of seven sections. This section, Section 1, includes background, knowledge gaps and significance, research questions and the structure of this dissertation.

Section 2 provides the review of relevant literature and builds the theoretical foundation for this dissertation research. In Section 3, the research aims, goals and hypotheses are introduced with a proposed conceptual model of this study. Based on that, this section provides a description of the general methodological approaches, including study setting, sampling, and research design, with an introduction to the two phases of this study that will follow in Sections 4, 5, and 6.

Section 4 covers the school-level analysis using the school-level data and full-survey data. This section explores the differences between neighborhood school and non-neighborhood schools based on explanatory variables related to school-community relations and social capital as well as socioeconomic and physical environmental factors of community. Section 4 includes introduction, method, results and discussion.

Sections 5 and 6 are studies utilizing individual-level data. Section 5 examines the big picture of the hypothesized associations between school-community relations, social capital and children's walking-to-school behaviors based on large sample data. Then, Section 6 explores in depth the role of social capital on the walking-to-school and social capital measurement based on the small sample sub-data from the parental social capital survey. Both sections include introduction, method, results and discussion.

Section 7 summarizes the key findings of this study and discusses the contributions and implications for relevant research in the future. This section also suggests policy implications and recommendations for designing and maintaining school-community relations for maximizing walking potential for school children and community's social capital.

Indicators and constructs this study uses include school's centrality for school-community relations; social cohesion, volunteerism, social trust, civic engagement or informal sociability for social capital; and walking-to-school behavior for physical activity. Children in this dissertation refer to elementary school-aged children, and schools refer to public elementary schools.

The detail of dissertation structure is provided in Figure 2.

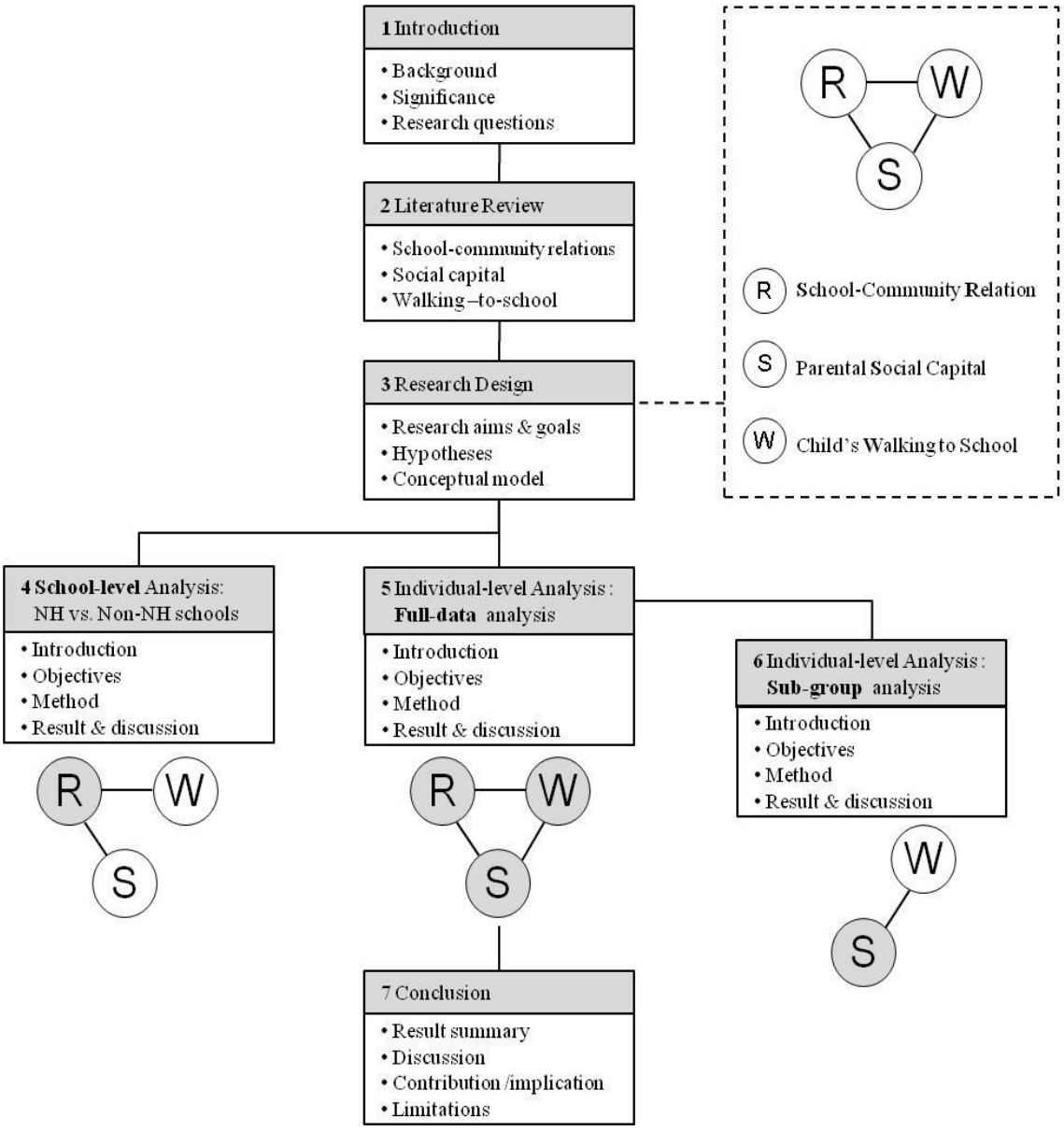


Figure 2

The Structure of Dissertation

2. LITERATURE REVIEW

This section consists of three sub-sections on the major topics of this dissertation, including school-community relations (2.1), social capital (2.2) and children's walking t-school behaviors (2.3), and one summary section (2.4). Relevant literatures have appeared since 1915 and have been searched in English using Google Scholar, ISI Web of Knowledge, and LibCat (Texas A&M University Online Libraries Service) from March 2010 through August 2011. Searching keywords include school community relation, neighborhood school, neighborhood plan, school planning, spatial centrality, social environment, social capital, social cohesion, public health, active transport, physical activity, and walking to/from school, etc.

Reviewed literatures are mostly from peer-reviewed journal papers, but are also from book chapters, government documents or reports, and web pages. The reference section of this study identifies those literatures using EndNote version X4.

The three major bodies of theoretical themes this section explores include school-community relations, social capital and children's walking to school behaviors. This literature review section covers the overall concept, definition and findings, but mainly focuses on the proxy indicators corresponding these themes this study explore: (a) school's centrality in community as school-community relations, (b) social capital measures (e.g., Putnam's five themes of social capital) as parental social capital, and (c) walking-to-school as children's physical activity.

First, the concept of a school's centrality as an indicator of school-community relations reflects a broader context of two-way communication between school and community. A school's centrality in a community mirrors various perspectives emphasizing cohesiveness of school-community connections based on both social and spatial distance between school and community. Thus, with a comprehensive view, the centrality of a school in the community needs to be measured not only with spatial but also with social dimensions. This study revisits the concept of Perry's Neighborhood Unit Plan applied to the socio-spatial centrality of a school into designing a community unit in order to develop a measurement scheme of the school's centrality in a community.

Second, this study employs a social capital concept to measure social environments of community. Among the varying definitions of social capital, this study uses its broad definition "integrations of social trust, norms, and networks that facilitate certain actions of individuals who are within the community" based on existing scientific approaches (Coleman, 1990; Farr, 2004; Putnam, 2001; Putnam, 1995).

While many studies have identified various correlates of social capital, related to human behaviors and health, there is a growing interest in studying the direct or indirect role of social capital on physical activity in various physical environmental settings of community. In spite of many criticisms, social capital is often suggested to be studied as a social contextual mediator of the relationship between physical activity and physical environment (King et al.,2002; Sun, 1999; Sallis et al., 2006). Also, social capital measurements from other studies are reviewed and considered selectively for application

to this study (Putnam, 2000; Coleman,1988; Hall, 1999; Spellerberg, 1997; Green et al, 2000; Blaxter et al, 2001).

The last part of the literature review focuses on exploring the outcome factor of this study, children's walking-to-school behavior as a proxy of children's physical activity. Children's active transport to school has often been regarded as an effective way for leading kids to engage in more moderate and vigorous physical activity (Alexander et al., 2005; Cooper et al., 2005; Fulton et al., 2005). It is also based on the behavior setting theory, an ecological model of physical activity which connects walking-to-school to daily destination within recurring social activity pattern.

2.1 SCHOOL AND COMMUNITY RELATIONS

Schools have traditionally played two roles in American society: first, they are related to individual, family and community; second, they stand as the primary institution charged with the preparation of children for the "broad" worlds of society, polity, and the nation (Driscoll, 2001). Also, the development of sound relationships between school and community is a necessary and natural function of a publicly supported institution in a democratic society (Kindred et al., 1976). Therefore, community involvement and more effective school-community relations are emerging as an important topic with both practitioners and academic researchers (Driscoll, 2001; Smrekar and Mawhinney, 1999; Leithwood and Jantzi, 1999).

With such an agreement on the significance of a school's role in the community, the following part of this study defines the term "school-community relations" and explores different perspectives and practices of it.

2.1.1 Definitions of Community

The term "community" includes "neighborhood" in this study. Although the distinction between them is often unclear, the main difference is that "community" can be not only a place-based but also a people-based term (e.g., social club) while "neighborhood" seems to imply primarily a geographical area (boundary) and residents within it. "Community (or neighborhood)" can be defined as: first, a community is often defined as a geographical unit. In practice, it is often said that there is no uniform or universal way of defining a neighborhood even though many administrative agencies and institutions designate geographical boundaries such as census tracts, school districts, or police district. Second, a community is also defined as a social unit or system. A community as "social area" implies a social system including interpersonal relationships, behaviors, participations, and its encompassing area (Chaskin, 1995). Similarly, it is also defined as (a) a physically and geographically distinguished area from other area, (b) an area of a population with unique social or demographic characteristics, (c) a social system or interaction by rules, norms and other social control and (d) related social behaviors or ways life around the area (Schwirian, 1983). Likewise, in this study, a "community" is defined both as a spatial and social unit. Especially, the administrative

unit related to school-community relations, such as the school attendance boundary, is commonly considered as a community unit.

2.1.2 Definitions of School-Community Relation

According to the America Association of School Administrators, the school-community connection is a cooperative mechanism of efficient two-way channels of information and understanding between the school, its personnel, and the community (AASA, 1950). This two-way system of cooperation implies both bringing the community into the school and taking the school out to the community by the school's supporting children and their families. Since children's walk-to-school behavior is to be broadly supported by both the school and parents, it is essential to understand the origins, theories and objectives of the excising concepts of school-community relations to cover two-way approaches.

Bringing the Community into the School: Narrow Approach It has been increasingly evident that the school in a dynamic social order cannot adapt itself to change nor improve its role without the participation of the community in its affairs (Kindred et al., 1976). As narrowly defined, "school-community relations" is a term that focuses on schools that engage in a reform-within-in-a-reform that involves a "bringing-in" of the community to school governance and improvement of school performance (Smylie et al., 1994).

In view of the background of the school in American society, this concept might begin with studies on the subject of "public school relations (or school publicity)" which

emphasizes the public character of the school and that the educational enterprise is one of shared ownership with citizen (Kindred et al., 1976). Moehlman defined public school relations as an "organized factual informational service for the purpose of keeping the public informed of its educational program (Moehlman and Van Zwoll, 1957)". Such a perspective centers on developing public consciousness of the significance of the educational process in a democratic society through active parental partnership and participation. However, as Kindred stated it as "a process of communication between the school and the community for the purpose of increasing citizen understanding of educational needs and practices and cooperation in the work of improving the school (Kindred, 1957)", this approach tends to adhere to the improvement of the educational program rather than the enhancement of school's social cohesion to the community with a larger support by educationalists.

Bringing the School into the Community: Broad Approach Even though some use the term "school-community relations" in keeping only with concepts concerning the involvement and participation of citizens in the educational decision-making process by the mid-1960s (Moehlman and Van Zwoll, 1957; Kindred et al., 1976; Kindred, 1957), the concept of a school's reaching-out to the community has had wide acceptance (Smylie et al., 1994). By using this term and the like, the community-level empowerment efforts for revitalizing the school-community connection has increased among people, organizations, events and educators (Crowson, 2001). It also expands on the creation of informal and social networks, including church and societies, family

support services, recreational opportunities and strong bonds among adults in the community (Schorr, 1997).

Likewise, the term, "school-community relations" has embedded in it the back-and-forth association between school and community. Even though the basic goal of the school may differ from those of parents, the very concept of school-community relations implies this two-way communication (Litwak and Meyer, 1974). However, the narrow interpretations of the community-school connection, which mainly focuses on educational improvement through community involvement, have been broadened to reemphasize the school-to-community outreaches based on a rich partnership among them. Thus, this study is taking a closer position to the latter, while holding both approaches to define the term, "school-community relations".

2.1.3 Social School-Community Relation

In a broader context of the social setting in a community, school children and their families have a direct connection with a school's social accessibility in a natural way. Litwak and Meyer (1974) put it in a most common sense way:

> Only a neighbor is in a regular position to tell a mother her child has wandered into the street; only a neighbor shares common interest with a mother about having a traffic light put on the corner so a small child can cross safely…only children in the neighborhood can provide the immediate everyday socialization that young children receive in their spontaneous play after school. A family must face up to the fact that, very likely, if the neighbor's children are not educationally well prepared, their own children will receive a lower standard of education in the local school (pg. 127).

Regardless of the presence of any program for school-community connections, the school already shares the social circumstances with the community since it is not just an educational institution but a social organization in a community; education also depends on a complementary relationship between forms of social organization. Therefore, to understand the social system of a school, to interpret community and to utilize the social cohesiveness between the school and community, it is essential to highlight these relations with a social perspective.

Litwak and Meyer (1974) theorize the typology of school-community relations based on the "social distance" between school, families and neighborhoods; the distance should be dependent on the viewpoint taken with respect to the importance of the community for the school's objectives to utilize its linkage with the community (Litwak and Meyer, 1974); first, the *"closed-door" position* is that the school perform its educational objectives within its walls, based on the general view of French and German educators. From this position, a school-community relation will best perform their program if it maximizes the social distance between the family and the school; second, the *"open-door" position* necessitates intimate school-community contacts based on the assumption that many of the basic educational processes occur outside the school walls including family, friends and community. This *"open-door" position* matters in a child's daily life as a necessary motivation and source of education. Recently, many cities implemented programs facilitating interactions between the school and families (i.e., community-joint-use program of school facilities), and their rich interactions will help develop or create more effective and productive relations (see Table 1).

Table 1

"Open- vs. Closed-door" Position Theory

	"Open-door position"	"Closed-door position"
Social distance	Close	Not close: Trying to maintain some distance
Educational focus	Socialization contribution good citizenship	Academic achievement
Voluntary association	Moderate: potentially very high when community is cohesive	Moderate
Informal connection	Very high	Very low
Formal authority	Very low	Very high

Source: Litwak and Meyer (1974)

The *"open-door" position* pursuing a close distance between school and community is broadly supported by sociologists and practitioners in many fields and education theorists including advocators of the "student-centered[1]" philosophy of education (Fusco, 1964; Litwak and Meyer, 1974). As mentioned before, since this study focuses on socially broader and active connections between school and community, the *"open-door" position* concept fits well into understanding children's walking-to-school behaviors within the context of social capital (being considered as both an outcome and a mediating factor).

[1] Student-centered (or pupil-centered) education is a concept in contrast to teacher-centered education. It is defined as a pedagogy "giving students greater autonomy and control over choice of subject matter, learning methods and pace of study (Gibbs, 1992)" with a focus on student's needs and their active responsibility while teacher-centered education is led by active roles of teachers with passive students.

2.1.4 Spatial School-Community Relations

The spatial relationship between school and community is not limited to their geographical locations, rather it should be understood considering social, economic, cultural, historical and personal connections occurring within a shared physical setting. If this relationship is along with the inventory of the community's resources within a physical community boundary, school-community relations can be referred as an "asset-based" association because of the central roles of schools as institution in which many vital assets are collected (Kretzmann and McKnight, 1996; Driscoll, 2001).

Likewise, Driscoll (2001) emphasizes the role of school in the community not just as a provider of instructional services to a community but also as a key element that can utilize its "sense of place" and provides the way for reclaiming the sense of place with neighborhood schools through: (a) a renewed appreciation of the physical settings of the school and its importance in the community; (b) a commitment on the safety issues extensively beyond the border of the school building; and (c) an awareness of history in the social construction between school and community (Driscoll, 2001).

From urban planning and practices, Perry's Neighborhood Unit Plan which was conceptualized in 1923, identified a community boundary as a half-mile walking radius and the elementary school location as the geographical center of the community (Frank et al., 2003). Perry's concept has a relationship with a "sense of place," as William Leach argues," a strong sense of community, along with the boundaries that shape it, not only fosters creativity but also helps to provide people – especially children – with an assurance that they will be protected and not abandoned (pg. 179) (Leach, 1999)". In

spite of criticisms[2] around this concept since its inception, the Neighborhood Unit Plan has since significantly influenced many local planning and subdivision design practices across the US and worldwide (Lawhon, 2009).

Currently, the fragmented school-community planning issues have been highlighted by planning researchers. Due to the separation of school planning from municipal land use planning, school planning can be separately considered as new school allocation policies and school facility design guidelines by educational administrations (Vincent, 2006). Such policy fallacies seem to create a significantly negative effect on existing school-community relationships.

The foremost and recent issue has been brought up with the "mega-school sprawl" phenomena which is about the trendy constructions of big schools in suburban areas that rule out the possibility of walking-to-school and renovating historical neighborhood schools (Beaumont and Pianca, 2002). The related fact is that schools have been increasing in size and drawing students from ever-expanding areas between 1940 and 1990. The total number of elementary and secondary public schools fell by 69%, despite a 70% increase in the U.S. population(Ewing et al., 2004). In fact, many public policies have contributed to this trend (Beaumont and Pianca, 2002; Vincent, 2006; Ewing et al., 2004) including: (a) the funding formulas in many states favoring new school

[2] First, one criticism is the exclusionary effect resulting in a neighborhood based on the unit. Like zoning effects, Perry's "self-contained" idea seems to have brought not only social homogeneity but social exclusiveness. Secondly, another criticism came from questioning if the physical design elements can meet the needs of the local and the time. For instance, Lawhon (2009) pointed out the school siting concept in Perry's plan reflected the then political idea of school and legislation in New York allowing the public after-hours use of school facilities, and the arterial boundary concept is also inspired by the facts that killed more than one child per day by traffic accidents on the streets of New York City in 1929. Finally, critics also questioned its potential social control in terms of physical determinism.

construction over renovation, (b) minimum acreage standards for new school development leading to the favoring of cheaper remote locations and (c) building codes designed for new construction being applied to all schools universally including small and old schools[3].

Accordingly, such problems are likely to be followed by other social and economic problems in communities as Vincent (2006) pointed out, "while many suburbs are growing and building schools, some of the greatest needs for new schools are found in built-out urban neighborhoods where available land is scarce, local economies tend to be more depressed, and households tend to be lower-income (Vincent 2006:434)." Baum (2004) included schooling as a major cause of sprawl with race and community exclusiveness (Baum, 2004). To solve these problems, McDonald (2010) suggests that planners through public participation, visioning and charettes need to help their community choose the optimal sizes and locations for their future schools as well as help school districts reflect the community needs in school siting guidelines (McDonald, 2010).

2.1.5 Socio-Spatial "Centrality" of School in Community

According to the previous studies, a school is not only an educational facility but also an important social infrastructure within a community in a democratic society. On that account, school-community relations should be considered with respect to both

[3] With an aware about the problems, In 2003, the Council of Educational Facilities Planners International (CEFPI) has removed the high minimum-acreage requirements from its standard school siting guidelines, and most States does not seem to apply this rule anymore (CEFPI, 2003).

spatial and social environmental dimensions because schools play roles as important public service facilities and they function as an essential social infrastructure of the community (Vincent, 2006).

As shown by the two-way communication concept and "open-door position" theory regarding school-community relations, educators, sociologists and practitioners have tried to make the social distance between the school and community close and cohesive as well as improve the academic achievements of its educational program. It is notable that the efforts have been shared by physical planners and policy makers over the last several decades. However, knowledge is lacking as to how to create socially and spatially integrated relations between schools and communities. Thus, this study considers both the social and spatial aspects of school-community relations.

School's Centrality in Perry's Neighborhood Unit Plan Concept The uniqueness of Perry's concept lies not only in the physical characteristics such as school location, pedestrian paths and neighborhood boundaries, etc., but also on the formation of community sociality. Perry considered the community sociality is one of the public assets conceived in place by place, or community by community (Kretzmann and McKnight, 1996). Originally, this conception was known as an expression of the ideals of social reformers "whose concern was primarily social, not physical and aesthetic" and who endeavored to maintain a constant interest in applying to urban planning with expansive social purpose (Silver, 1985).

In fact, Perry attempted to organize space and socialize neighborhoods at the same time (Keating and Krumholz, 2000), so his plan can be regarded as a form of social

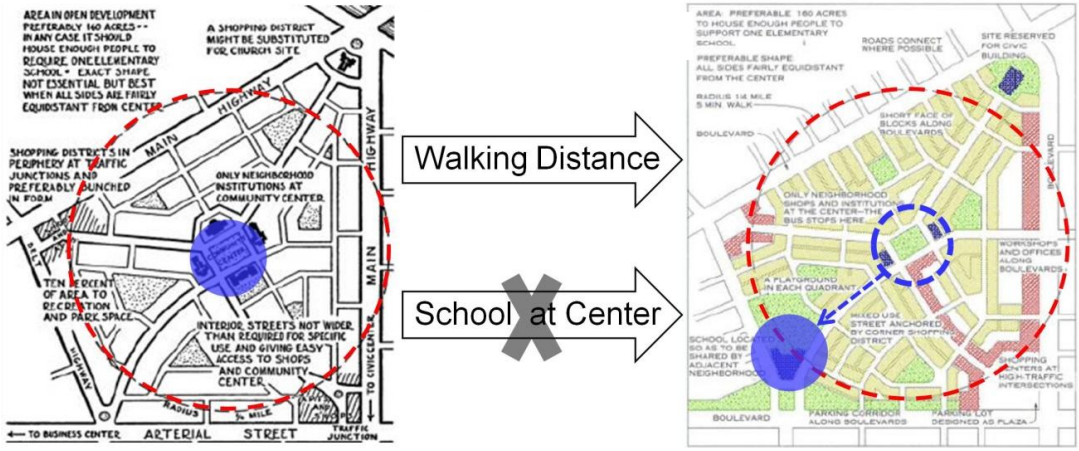
control pursing a social rationality[4]. Even though such a social approach by physical planning has not been welcomed by everyone, Perry's conceptions deserve to be explored as a relevant planning guideline even now. This concept has been especially highlighted with favor as a planning concept for the protected neighborhood environment, especially for children and outdoor social life (Appleyard, 1980; Frank et al., 2003).

Regarding school-community relations, however, Perry's original concept of "school service sphere (Perry, 1925)" does not seem to hold in contemporary urban development with sprawling schools and a growing mismatch between schools and residential communities. For instance, the New Urbanism concept which has currently become one of the most popular neighborhood concepts, seems to reflect the market forces more than the value of school in its unit plan. Duany Plater-Zyberk (1994) did not inherit Perry's concept of school's centrality in the community but still respected the walkable distance (1/4 miles) when delineating a community boundary. However, the walking distance concept was developed based on the school's location at the center and its service sphere (see Figure 3).

Therefore, it will be meaningful to reclaim the school's centrality in the community and to examine a school's spatial and social position in the community in order to highlight community member's social capital and children's walking to school.

[4] Perry's concept has been criticized due to the nature of a community's exclusiveness embedded in the plan. Chapin and Richman noted, "it encouraged the formation of neighborhoods of similar racial, ethnic, and class backgrounds which, as is widely evident today…..unwittingly came to be exclusionary." They argue that the exclusiveness of a neighborhood might threaten the social mixture otherwise inherent in a local neighborhood (Chaskin and Richman, 1992).

Clarence Sir Perry (1929) Duany Plater-Zyberk (1994)



Source: Perry, 1929; Ramsey and Sleeper, 1994

Figure 3

Changes in School's Centrality from Neighborhood Unit Plan to New Urbanist Schemes

2.2 SOCIAL CAPITAL

There have been many studies since the 1990s to define, conceptualize and measure social capital. Coleman (1990) initiated the first scientific approach to conceptualize of social capital for research purposes (Baron et al., 2000). Further, Putnam (1993; 1995) is currently well known for his work in importing the social capital concept from academia to practical applications and even media (Farr, 2004; Harper, 2002). More recently, a growing number of studies have focused on its effect on various human behaviors and society, including physical activity (Ziersch et al., 2005; Holtgrave and Crosby, 2004; Weitzman and Kawachi, 2000; Walker et al., 1997; Uzzi, 1997; Baker, 1990; Gabbay and Zuckerman, 1998; Lindstrom et al., 2001).

2.2.1. Definitions

Originally the term "social capital" traces back to Marx's use in the nineteenth century as "capital from the social point of view", which is a counter concept against capitalist's capital from the perspectives of political economy (Farr, 2004). Although there are some researchers still using this term in order to distinguish it from physical and monetary capital (Buchanan, 1995; Woolcock, 1988), the contemporary concepts of social capital have been built on social perspectives rather than on political economy. In this context, Farr (2004), an American political scientist, separates the concepts of theorists like Dewey, Hanifan and Tocqueville from that of political economists; "The political economists of the nineteenth century—from Marx to Marshall to Bellamy—took capital from the social point of view. Today's social capitalists, apparently, take

"the social" from capital's point of view. The one reflected an age coming to terms with capital, the other an age coming to capital for its terms.

Since the 1980s, contemporary conceptualizations of social capital have been introduced in common social perspectives, but with varying approaches. Those identify social capital as a social network which is based on the relationship of individuals with one another or human capital. However, there exists a difference in how to define social capital according to: (a) status-oriented, (b) process-oriented, (c) output-oriented, and (d) integrative approaches (see Table 2).

First, the early social perspectives seem to have focused on the existing status of the social network to explain social capital (Jacobs, 1961; Seeley et al., 1956; Dewey, 1898). Bourdieu (1985) stressed the actual (or potential) resources that link to a network of relationships of mutual acquaintance and recognition. Loury (1992) emphasizes that such social relationships occur naturally among human capital (Bourdieu, 1985; Loury, 1992). This status-oriented approach tends to identify the social relationship as social capital and highlights how social networks exist among persons and their activities. The second perspective is more process-oriented and mainly explains how social capital can be built and maintained. These concepts focus on purposes, resources and abilities, learning knowledge, trust and norms to support social capital building in its process (Brehm and Rahn, 1997; Fukuyama, 1995; Woolcock, 1988; Baker, 1990). Third, some approaches emphasize the input-output mechanisms of social capital. For instance, Inglehart (1977) expects social capital to help extend its voluntary associated actors within civil society. Schiff (1992) addresses social capital's influences on relations

among people as inputs of the production and/or utility function of social structure (Inglehart, 1977; Schiff, 1992).

Table 2

Definitions of Social Capital

Approach	Authors	Definitions
Status-oriented	Dewey (1898)	"The network of activities that bind people together" (pg.362)
	Seeley et al. (1956)	"Status that individuals accrued or lent as a result of their group activities; the sociologists did not conceal their critical distance from this commodity similar to money." (Farr 2004, pg.9)
	Bourdieu (1985)	"The aggregate of the actual or potential resources that are linked to a durable network of more or less institutionalized relationships of mutual acquaintance and recognition." (pg. 248)
	Loury (1992)	"Naturally occurring social relationships among persons which promote or assist the acquisition of skills and traits valued in the marketplace." (pg. 100)
Process-oriented	Baker (1990)	"A resource that actors derive from specific social structures and then use to pursue their interests; it is created by changes in the relationship among actors." (pg.619)
	Fukuyama (1995)	"The ability of people to work together for common purposes in groups and organizations." (pg.10)
	Brehm and Rahn (1997)	"The web of cooperative relationships between citizens that facilitate resolution of collective action problems." (pg.999)
	Woolcock (1998)	"The information, trust, and norms of reciprocity inhering in one's social networks." (pg.153)
Output-oriented	Inglehart (1977)	"A culture of trust and tolerance, in which extensive networks of voluntary associations emerge." (pg.188)
	Schiff (1992)	"The set of elements of the social structure that affects relations among people and inputs or arguments of the production and/or utility function." (pg.160)
	Thomas (1996)	"Those voluntary means and processes developed within civil society which promotes development for the collective whole." (pg.11)
Integrated	Coleman (1990)	"Not a single entity, but a variety of different entities having two characteristics in common: they all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure". (pg. 302)
	Putnam (1993)	"Features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions." (pg. 167)

Beyond these three distinctive approaches, efforts have been made to integrate the various social capital definitions with broader theoretical frameworks. Among those, Coleman (1990) defines social capital as, "not a single entity, but a variety of different entities having two characteristics in common: they all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure (Coleman, 1990)." Similarly, Putnam (1993) bridged all the different features of social organization and defined social capital as integrations of trust, norms, and networks which might be outputs from coordinated actions of society (Putnam, 1993).

2.2.2. Social Capital as an Indicator of Social Environments

In community-level studies, social capital can play a role as an indicator of the social environment of the community. A community has been defined as a social entity with a geographical boundary (Schwirian, 1983; Chaskin, 1995). Community is often referred to as a "social area," represented by social homogeneity, or similarity of the social organization (Schwirian, 1983). This implies interpersonal relationships, behaviors, participations and systems of community members (Chaskin, 1995). The functional associations of community is highlighted as "the social place used by family, friends, neighbors, neighborhood associations, clubs, civic groups, local enterprises, churches, ethnic associations, temples, local unions, local government, and local media (McKnight, 1987)"; that implies that a community is a social system model which includes the interpersonal ties, participations and its encompassing area. Thus, the social environment of the community can be indicated by collective social behaviors from

individual community members who are bound by spatial region and share social infrastructures.

Regarding the theoretical framework of this study, there are three primary reasons why social capital can be an indicator of the social environment within the relationship between school and community. Foremost, as mentioned above, social capital embraces social network concepts which focus on bonding individuals together. Most studies stress the role of social capital as the linkage between individuals and a social entity, which can be community. As Szreter and Woolcock redefined the functional typology of social capital as "bonding," "bridging" and "linking", it exists to connect individuals to community and broader society (Szreter and Woolcock, 2004). In addition, community-based mediating on social capital will be exposed clearly, especially in the creation and results from it; because the creation of social capital requires efforts (investment) and allows their purposeful use later on other similar forms of capital (Becks et al., 2004). Likewise, social capital tends to be built as an input-output system and is expected to have productive social output such as a social network. Accordingly, it has a process of building, requiring time and collaborative activities from individuals within a social system. Thus, even though social capital is not a tangible entity, the actors and their activities can to be tangible to each other both cohesively and productively.

Second, the social capital concepts are related to a social learning process of community. The learning knowledge to create social capital among a potentially cohesive group in a community is crucial. According to Schumpeter's model of

knowledge for creation of social capital, it starts from mutual understanding of the current status of individuals. Also, it encourages bridging each actor together (who oftentimes are isolated) to facilitate communication. Eventually in order to establish and maintain social relations, social trust will be built by such collaborative learning processes (Schumpeter, 1934). Also, as results (or processes) of social capital, voluntary organizations and activities facilitated by social communication and cohesion reflect the importance of community-based structures of social capital. The levels of democratic participation can be evidences of members' common bonds with each other and their capacity for trust and collaboration. In this context, Couto and Guthrie (1999) suggested community-level forums including churches and voluntary organizations to promote participation in society by community members (Couto and Guthrie, 1999). Likewise, Becks et al. (2004) stress the importance of learning processes of social capital in the community (Becks et al., 2004).

Finally, social capital utilizes and relates social infrastructure to community, such as elementary schools. According to Hanifan (1916), social capital "tends to make these tangible substances count for most in the daily lives of people, namely, goodwill, fellowship, mutual sympathy and social intercourse among a group of individuals and families who make up a social unit, the rural community, whose logical center is the school." Hanifan also stated, "In community building as in business organization and expansion, there must be an accumulation of capital before constructive work can be done (Hanifan, 1916)." In the same context, Driscoll and Kerchner (1999) believed that schools can help to build social capital in communities, Coleman (1988) proposed that

social capital has been used to account for schooling and educational attainment, and Becks (2004) pointed out the importance of the institutional setting in a community whose primary purpose is knowledge acquisition and the transfer of social capital, such as schools (Coleman, 1990; Driscoll and Kerchner, 1999; Becks et al., 2004). Another line of studies identifies education as a key factor in creating social capital and greater educational achievement as an important outcome (Putnam, 2000; Halpern, 1999).

A growing number of studies have identified social capital on a community level. For instance, it was found that there are significant neighborhood differences in individual perceptions of trust, substantiating the notion of social capital after accounting for individual and socioeconomic characteristics in different communities (Subramanian et al., 2003). Similarly, an Australian study showed significantly different levels of social capital based on community settings (rural, metropolitan and inner city areas) when participation in networks, reciprocity, trust, social norms, the commons, and social agency are measured (Onyx and Bullen, 2000). Recent evidences also showed a favorable social environment including social capital concepts was positively associated with some children's physical activity while physical environment was not significantly associated with it (Franzini et al., 2009; Franzini et al., 2010).

2.2.3 Relationship with Health and Physical Activity

Currently, studies on social capital have focused on its effect on human behaviors and emotions, economic productivity, entrepreneurship and organizations, and labor sociality (Ziersch et al., 2005; Holtgrave and Crosby, 2004; Weitzman and Kawachi,

2000; Walker et al., 1997; Uzzi, 1997; Baker, 1990; Gabbay and Zuckerman, 1998). Also, most recent studies, since the 2000s, in the health-related fields have revealed the relationship between social capital and human health. Community-level studies especially support social capital's positive effect on human health as documented by self-reported health status (Wen et al., 2003; Gabbay and Zuckerman, 1998; Subramanian et al., 2002), mortality (Skrabski et al., 2003; Lochner et al., 2003; Kawachi et al., 1997; Kennelly et al., 2003), and psychological depression (Pollack and von dem Knesebeck, 2004; Ziersch et al., 2005).

Evidence on physical activity is still limited but has been growing in recent years. A study demonstrated that children having positive perceptions of social capital and social networks in the neighborhood tend to be more physically active (Hume et al., 2009), and another research points out that socioeconomic differences in leisure-time physical activity are likely to be due to differing social capital between socioeconomic groups (Lindstrom et al., 2001). Similarly, Leyden (2003) provided evidence that the pedestrian-oriented, mixed-use neighborhoods have higher levels of social capital compared with those living in car-oriented suburbs in reference to knowing their neighbors, participation, trust and social engagement (Leyden, 2003).

However, in spite of increased interest in social capital's effects on health and physical activity, studies have not captured socio-political imaginations or socio-economic status in communities sufficiently due to a lack of terminological precision and theoretical rigor regarding social capital (Baum, 1999). Thus, it might be controversial to assume a direct effect of social capital on human health, especially in

community-level studies. However, if social capital is understood as an indirect or contextual effect on, for instance, physical activity, that would provide a more acceptable approach related to human health. In this respect, it is often suggested that social capital is to be studied as a social contextual mediator of the relationship between other factors including human behavior, physical activity or physical environment (King et al., 2002; Sun, 1999; Sallis et al., 2006).

2.2.4 Criticism

While social capital has emerged as one of the most popular concepts regarding social relationships in many fields because of its intuitive appeal, it has been at the centre of many controversies due to its broad, and also often vague, concepts and uses. There are several major controversies around conceptualizing and measuring social capital are as follows.

First, it is unclear whether social capital is understood as an aggregation from the relational individuals or a collective asset of a group. If seen at the group level, the perspectives on identifying the certain group also vary[5] – neighborhood, local, state, national (Lin, 1999).

Second, controversy pinpoints the identification[6] of social capital not as a single entity but as a variety of different entities (Coleman, 1990). Koniordos (2008), Portes (1998) and Lin (1999) proposed that it would be impossible to build a theory where

[5] Robert Putnam (2000) utilized the state-level analysis of social capital across the Unites States.
[6] Lin (1999) calls this view "functionalism".

factors are folded into a singular function, if social capital captures such broad characteristics (Koniordos, 2008; Lin, 1999; Portes, 1998).

Other major criticisms lie in the premise of some of the views of functionalism as with Coleman, Bourdieu and Putman, that there is closure or density in social relations and social networks (Portes, 1998); which means that there is a certain membership and density in the group that exists with a clear demarcation excluding outsiders. However, such a requirement for network density or closure for utilizing of social capital is not likely to be necessary or realistic; and which, ironically, denies the importance of bridging or unofficial ties which might be another indicator of social capital (Lin, 1999; Schuller et al., 2000).

In addition, many criticisms have arisen with the limitation of Robert Putnam's popular view. Such criticisms include the fundamental questions, "How do norms and networks of civic engagement undergird good government (Levi, 1996)?" or "Is democratization by his social capital concept on the right direction for democracy, or colored by the political mood in the Unites States (Putzel, 1997)?", insufficient explanation about an individual's preference (Sobel, 2002), and incompatibility with different society and geographical locations (Navarro, 2002), etc.

However, Putnam's theory contains a powerful thesis, extensive data and statistical analysis with a broad accessibility from sociologists, social psychologists and economists (Sobel, 2002). Other social capital discourse has also stimulated a large number of follow up studies for revisiting social networks and civic involvement in the contemporary democratic society.

2.2.5 Measurements

Various measures of social capital have been introduced since Coleman (1988) developed the social capital indicator for children's educational attainment with personal, family and community dimensions (Coleman, 1988) (Table 3). Hall (1999) considered networks of sociability and norms of social trust as measurement themes (Hall, 1999). Putnam (1995) employed a comprehensive social capital index with 14 indicators to measure community organizational life including engagements in public affairs, community volunteerism, informal sociability and trust (Putnam, 1995). Similarly, Spellerberg (1997) suggested the measurement framework including identity/belonging, belief, trust, values, and participation in social networks from formal institutions to informal groups (Spellerberg, 1997). Green et al. (2000) added neighborhood context and geography to the existing indicators, such as trust, reciprocal help and civic engagement (Green et al., 2000). Blaxter et al. (2001) developed a survey matrix by employing five social capital themes: participation (or social engagement), control and self-efficacy, perception of community, social interaction/ networks/ support and trust (or social cohesion) (Blaxter et al., 2001; Harper, 2001).

Although no agreement exists on the standard measures, most published studies use social trust, social networks, social cohesion, civic participation, reciprocity, neighborhood connection and volunteerism as common indictors (Table 3). Among these, Putnam's longitudinal work (2000) has brought national attention and focus on the individual and community level measurements of social capital in spite of ongoing debate about terminological confusion and theoretical rigor (Baum, 1999; Farr, 2004). In the Social Capital Community Benchmark Survey, based on a composite index of 14 items representing the individual's tendency toward social behaviors in terms of social capital; these 14 items are loaded into 5 themes, including community organizational life, engagements in public affairs, community volunteerism, informal sociability, and social trust (Putnam, 2000; Harper, 2001) (Table 2 and 3). Consequently, through this study, Putnam provided evidence that social capital is highly correlated with good educational outcomes, good health, and good government (Sobel, 2002).

Table 3

Measurements of Social Capital

Authors	Index and indicators
Coleman (1988)	Children's educational attainment: personal and family dimensions - Personal dimension: socio-economic status, ethnicity, etc. - Family dimension: siblings, residential moves, mother's working, mother's expectation of children's educational attainment, communication level between children and parents, if parents present in household, etc.
Hall (1999)	Formal and informal networks of sociability Norms of social trust associated with social networks
Putnam (1995,2000) (The Social Capital Community Benchmark Survey, etc.)	Community organizational life - Servings as committee / office of local organization - Number of civic and social organizations / club meeting attended / group memberships Engagements in public affairs - Presidential election, attending public meeting on town/school affairs Community volunteerism - Number of non-profit organizations / working times on community project and volunteer works Informal sociability - Visiting friends / entertaining at home Trust - Level of trust people
Spellerberg (1997)	Population groups - Sex, age, ethnicity, family, health status, education, labor force, income, occupation, region, etc. Attitudes / values - Identity/belonging, values and goals, fears, attitudes, history, confidence, trust, etc. Participation in social networks (from formal institutions to informal groups) - Courts, parliament, local government, education, church, market place, unions, communities, clubs and societies, networks of neighbors, friend, families
Green et al (2000)	Empowerment and trust index - Neighborhood context / geography - Reciprocal help and trust - Civic engagement and efficacy - Health and life style - Economy
Blaxter et al (2001)	Participation / social engagement / commitment Control / self-efficacy Perception of community level structures or characteristics Social interaction / social networks / social support Trust / reciprocity / social cohesion

Reproduced from Harper, 2001

2.3 CHILDREN'S WALKING TO SCHOOL BEHAVIORS

Over the past several decades, increasing attention has been paid to the significance of the obesity problem in children. The childhood obesity epidemic in America has recently captured presidential concern because this problem is also known to impose substantial economic implications such as increased direct and indirect national medical costs in addition to the effects on children's health[7](Barnes, 2010).

To reduce childhood obesity, among various strategies including providing healthy and affordable food, encouraging good parental care, limiting screen time, and so on, getting children more physical activity is recognized as a key strategy (Barnes, 2010; Maffeis et al., 1998; Sallis and Glanz, 2006).In addition to many personal and social factors, studies also reported that home and neighborhood environments play a significant role in promoting children's physical activity (Davison and Lawson, 2006; Hume et al., 2009; Hume et al., 2005; Roemmich et al., 2006; Sallis and Glanz, 2006).

2.3.1 As an Indicator of Physical Activity

In particular, "walking-to-school" of school children is an active transport which is a way to promote physical activity as a part of routine daily activities. Children who walk or bike to school are, reportedly engaged in more moderate to vigorous physical activity than other transportation users (Alexander et al., 2005; Cooper et al., 2005; Fulton et al., 2005). Studies also found walking-to-school is not related to overall

[7] This White Paper reported "obesity has more than tripled among children and adolescents between the survey periods 1976–80 and 2007–08" and addressed "approximately 70% of obese children had high levels (> 90th percentile) of at least one key risk of health problems such as heart disease, and 30% had high levels of at least two key risk factor." (Barnes, 2010, pg. 6)

physical activity but likely due to confounding socioeconomic factors. Still walking-to-school is a good means to help children develop active life styles. Undoubtedly, along with increased childhood obesity, nationwide declines in the number of children's walking-to-school behaviors have been witnessed (McDonald, 2007; Ogden et al., 2002).

To find keys to promote childhood walking-to-school behaviors, studies have identified various correlates of children's school transportation including distance, weather, traffic, crime safety, school location, home-to-school paths and community environments (Davison and Lawson, 2006; Hume et al., 2009; Hume et al., 2005; Roemmich et al., 2006; Sallis and Glanz, 2006; Chaudhuri, 1996; Sallis et al., 2001; Zhu and Lee, 2008b). Findings show that community environmental supports around home-to-school routes and school settings are needed to promote children's active transport to school. The 2010 Presidential White Paper also pointed out that the environmental factors affecting school transportation as one of the major links to a heightened risk of obesity (Barnes, 2010).

2.3.2 Correlates of Children's Walking to School Behaviors

2.3.2.1 Demographic and Social Environmental Correlates

Socioeconomic correlates to children's walking-to-school are found in both personal and community levels. Personal-level correlates are measured from both children and parents. Most studies are based on a cross-sectional research design and survey, and few studies used a focus group study.

Personal backgrounds factors from recent studies include both children's and parent's (or family's) socio-demographic and economic characteristics. First, children's socio-demographic factors related to walking-to-school are gender (Fulton et al., 2005; McMillan et al., 2006; Merom et al., 2006), age or grade (Fulton et al., 2005; McMillan et al., 2006; Merom et al., 2006; Gilhooly and Low, 2005) and ethnicity (Evenson et al., 2003; Braza et al., 2004; McDonald, 2007). Second, many parent and family socioeconomic correlates are found, such as parent's socioeconomic status (Ewing, 2005; Ewing et al., 2004; Mota et al., 2005), highest educational level(McMillan et al., 2006; Mota et al., 2005), car ownership or having a driver's license (Merom et al., 2006; Schlossberg et al., 2006b; McDonald, 2007) and the number of children in the household (McDonald, 2007a, McMillan et al., 2006).

Personal perceptions and attitudes factors have been shown as important correlates to children's walking-to-school behavior by several studies. Parent's perceptions of the importance of physical activity and their actual participation are shown to be positive correlates (McMillan et al., 2006; Merom et al., 2006; Ziviani et al., 2004; McMillan, 2007), while parent's unavailability of walking with children and convenience in driving-to-school are negative correlates (McMillan, 2007; Salmon et al., 2007).

In addition, *community-level social factors* are should not be neglected. The correlates include peer influence factors such as having other children living nearby to walk with (Timperio et al., 2006; Salmon et al., 2007), perceived school climate (Evenson and McGinn, 2005), social environments like social control and social

cohesion (McDonald, 2007), and the number of community groups (McDonald, 2007; McMillan, 2007) (see Table 4).

Table 4

Demographic and Social Environmental Correlates

	Factors	Type	(±)[a]	Source
Socio-Demographic: Children's	Gender (boy* vs.girl)	Cross-sectional	(–)	Fulton et al., 2005b; McMillan et al., 2006; Merom et al., 2006
	Age	Cross-sectional	(+) (–)	Fulton et al., 2005b; McMillan et al., 2006; Merom et al., 2006; Gilhooly and Low, 2005
	Ethnicity (White* vs. non-White)	Cross-sectional	(+)	Evenson et al., 2003; Braza et al., 2004; McDonald, 2007
Socio-Demographic: Parent's & family's	Socioeconomic status	Cross-sectional	(–)	Ewing, 2005; Ewing et al., 2004a; Mota et al., 2005
	Highest educational level	Cross-sectional	(–)	McMillan et al., 2006; Mota et al., 2005
	Car ownership / Driver's license ownership	Cross-sectional	(X)	Merom et al., 2006; McDonald, 2007a; Schlossberg et al., 2006b; McDonald, 2007a
	# of children	Cross-sectional	(–)	McDonald, 2007a; McMillan et al., 2006
Personal Perceptions and Attitudes	Perceptions of the importance of physical activity (parent's)	Cross-sectional	(+)	McMillan et al., 2006; Merom et al., 2006; Ziviani et al., 2004
	Parental participation in physical activity	Cross-sectional	(+)	McMillan et al., 2006; Merom et al., 2006; Ziviani et al., 2004
	Parent's availability of walking with children	Cross-sectional		McMillan, 2007; Greves et al.; 2007b; Salmon et al., 2007
	Parent's / children's preference of driving-to-school	Cross-sectional	(–)	Salmon, et al.,2007; McMillan, 2007; Salmon et al., 2007; Greves et al., 2007
Community's Social Influences	Peer influence - Other children living nearby - Other children walking with	Cross-sectional	(+)	Timperio et al., 2006; Salmon et al., 2007
	Social environment - Social cohesion - Social control	Cross-sectional	(+)	McDonald, 2007b
	# of community group	Cross-sectional	(–)	McDonald, 2007b; McMillan, 2007
	Perceived social support	Cross-sectional	(+)	Evenson and McGinn, 2005

a. Correlate directions: (+): positive; (–) negative; and (X) no correlate

*. Reference group

2.3.2.2 Built Environmental and Safety Correlates

With a growing concern about the role of physical environment on children's physical activity, many studies have focused on various types of physical environmental correlates to children's walking to school (Table 5). Physical environmental factors are mostly focused on physical features along walking-to-school routes or related perceptions around the route, and the physical environments of the school or neighborhood as the origin-destination. Findings include travel time/distance, safety perception, school environment, community environment, and transportation Infrastructure.

First, *travel time* and *home-to-school distance* are the most significant correlates of walking-to-school evidenced by many studies; both objective and subjective measurements show negative relationships with walking-to-school (Zhu and Lee, 2008a; Zhu and Lee, 2009; McDonald, 2008a; Ulfarsson and Shankar, 2008; Yarlagadda and Srinivasan, 2008; Yelavich et al., 2008; Yeung et al., 2008; Larsen et al., 2009; Rodriguez and Vogt, 2009; Mitra et al., 2010). Regarding the travel distance, studies also tried to identify the thresholds of the tolerable walking distance for children. Most define it as 0.5 mile or 1 mile but it varies depending on the other confounding factors or environmental conditions (Merom et al., 2006; Schlossberg et al., 2006a; McDonald, 2007; McMillan, 2007).

Second, the safety perceptions of parents and children are reported to be another significant correlates of walking behaviors. Safety perception correlates from previous studies include neighborhood safety (Greves et al., 2007; Ahlport et al., 2008), overall

safety of walking (Zhu and Lee, 2008a; Zhu and Lee, 2009; Yeung et al., 2008; Rodriguez and Vogt, 2009) and safety from traffic (Greves et al., 2007; Panter et al., 2009).

Third, regarding home to school travel, the environmental correlates of origin and destination, home and school, are examined. School environmental correlates include school type (Robertson-Wilson et al., 2008), school location (Robertson-Wilson et al., 2008; Napier, 2010), and the school's recreational facilities (Colabianchi et al., 2009; Clifton and Kreamer-Fults, 2007). Community environmental correlates include population density (Clifton and Kreamer-Fults, 2007; McDonald, 2008b; Nelson et al., 2008; Larsen et al., 2009) and land-use mix (Larsen et al., 2009).

Last, but significantly, findings reporting about transportation infrastructure correlates related to both walking/bicycling and motorized transportation are examined. Walking-related transportation infrastructure reported to be correlated with walking-to-school are intersection density (Panter et al., 2010; Dalton et al., 2011), street connectivity (Mota et al., 2007), sidewalk coverage and quality (Berjleri, 2010; Ahlport et al., 2008; Zhu and Lee, 2009), and crosswalks (Zhu and Lee, 2009). Motorized-transportation infrastructure are mostly reported as physical barriers to walking behaviors, such as higher speed limits (Abdel-Aty et al., 2007), streets with heavy traffic (Zhu and Lee, 2009; Zhu and Lee, 2008a; Abdel-Aty et al., 2007), no traffic signals (Mota et al., 2007), and the presences of highways, freeways or major roads (Zhu and Lee, 2009; Zhu and Lee, 2008a; Berjleri, 2010).

The summary of physical environmental correlates is presented in Table 5.

Table 5
Built Environmental and Safety Correlates

	Factors	Type	Measure [a]	(±)[b]	Source
Travel time / Home-to-school distance		Cross-sectional	S(P), S(C), O	(–)	Salmon, 2007; Zhu & Lee, 2008; Zhu & Lee, 2009; McDonald, 2008; Ulfarsson & Shankar, 2008; Yarlagadda & Srinivasan, 2008; Yelavich 2008; Yeung et al., 2008; Larsen, et al., 2009; Rodriguez & Vogt, 2009; Mitra et al., 2010
Safety Perception	Neighborhood safety	Focus group	S(P), S(C)	(–)	Greves, et al., 2007; Ahlport et al, 2008
	Safety concern	Cross-sectional	S(P), S(C)	(–)	Zhu & Lee, 2008; Zhu & Lee, 2009; Yeung, et al., 2008; Rodriguez & Vogt, 2009
	Traffic concern	Cross-sectional	S(P)	(–)	Greves, et al., 2007; Panter, et al., 2009
School Environment	School type (public* vs. non-public)	Cross-sectional	O	(–)	Robertson-Wilson, et al., 2008
	School location (urban* vs. rural)	Cross-sectional	O	(–)	Robertson-Wilson, et al., 2008
	School location (presence in local community)	Cross-sectional	O	(+)	Napier, 2011
	Recreational facility	Cross-sectional	O		Colabianchi, et al., 2007; Clifton & Kreamer-Fults, 2007
Community Environment	Population density	Cross-sectional	O	(–)	Clifton & Kreamer-Fults, 2007; McDonald, 2008; Nelson, et al., 2008; Larsen, et al., 2009
	Land-use mix	Cross-sectional	O	(+)	Larsen, et al., 2009
Transportation Infrastructure: walking-related	Intersection density (street density)	Cross-sectional	S(C), S(P), O	(+)	Panter, et al., 2010; Dalton, et al., 2011
	Street connectivity	Cross-sectional	S(C)	(+)	Mota, et al., 2007
	Sidewalk coverage / Sidewalk quality	Cross-sectional, Focus group	S(C), S(P), O	(+)	Bejleri, 2010; (Ahlport et al., 2008)Ahlport et al., 2008; Zhu & Lee, 2009
	Painted crosswalk	Cross-sectional	S(P)	(+)	Zhu & Lee, 2009
Transportation Infrastructure: driving-related	Speed limit	Cross-sectional	O	(–)	Abdel-Aty, et al., 2007
	Traffic volume / busy road	Cross-sectional	S(P)	(–)	Zhu & Lee, 2009; Giles-Corti, et al., 2011
	Highway/ freeway/major road	Cross-sectional	S(P)	(–)	Zhu & Lee, 2008; Zhu & Lee, 2009; Bejleri, 2010
	Traffic signals	Cross-sectional	S(C)	(+)	Mota, et al., 2007

a. O: objective measures, S(P):subjective measures from parents and S(C): subjective measures from children
b. Correlate directions: (+): positive; (–) negative
*. Reference group

2.3.3 Behavior Setting Theory

Behavior setting theory, one of the ecological models of the physical activity field, has been widely used as a framework for active living policy and environmental research, based on the concept that behavior represents the interaction of the person and the environment (Sallis et al., 2006). It deals with four major domains of active living, including recreation, transport, occupation and household.

According to this theory, the behavior settings are the places where physical activity may occur; and physical activity in that behavior setting is associated with recurring patterns of organized social activities (King et al., 2002; Sallis et al., 2006). Therefore, children's walking-to-school "behaviors" have schools and homes which are destinations as well as "behavior settings" of their physical activity.

In this study, the behavior settings can be expanded from home-school to the school-community surroundings, such as school attendance boundaries. Also, under the concept of this theory, the behavior settings are connected to the social environmental settings to capture the effect of social cohesion of the community on children's physical activity by considering parental social capital.

2.4 SUMMARY

First, many studies and philosophies support the significance of the school's role in the community from educational and social perspectives. Also planning practices and research explores the school's centrality in the community for socio-spatial school-community connections. However, few empirical studies examine the influences of school-community relations on the community member's behaviors such as children's physical activity, parents' social engagement, etc.

Second, social capital is a popular concept for indicating social environment in the community level. In spite of various definitions, measurements focusing on social trust, cohesion, informal sociability, civic engagement and volunteerism are commonly used. Most recent studies identified social capital's associations with human health, behaviors and emotions. But still, only a few studies examined the correlates with the built environment and community environments.

Third, to predict walking-to-school behavior of school kids in this study, significant correlates from previous studies are investigated. These correlates include diverse built environment, social, safety, demographic and personal factors. However, lacking is an overall lack tailored theory based on the school environment among school-aged children.

The following section will interlock these three main themes of this dissertation study under a tailored conceptual framework (Figure 4). Also, reviewed correlates are employed to build the models for this study using children's walking-to-school behavior as an outcome variable.

3. RESEARCH CONCEPT AND DESIGN

3.1 RESEARCH CONCEPT

3.1.1 Conceptual Basis

As reviewed in the previous section, this study uses the behavior setting theory and social capital concept as its key theoretical basis. First, the behavior setting theory focuses on the places where physical activity may occur (Sallis et al., 2006) and physical activity in a behavior setting is associated with recurring patterns of organized social activities (King et al., 2002). As school is a daily destination for children and their parents, and a potential destination for other community members, behavior setting theory serves as a good theoretical foundation for this study. Second, although the social capital concept has not been popularly applied in physical activity research, it offers important guidance to studying the concepts of social trust and civic engagement (King et al., 2002; Sallis et al., 2006). Also, social capital is relevant to the multi-level relationships between children, parents, and community-school. Thus, this study will attempt to bridge those theories and concepts by focusing on the physical and social dimensions of a school within the larger community.

In addition, the theoretical basis for school-community relations is supported by theories of social distance between school and community such as the open-door position theory, which is related with the everyday life of the child and family (Litwak and Meyer, 1974) based on a pupil-centered philosophy of education (Thompson and Tom, 1957). For instance, this theory argues that school facilities should be installed to

support families in the community with their everyday living needs (Litwak and Meyer, 1974). The association between physical school-community relations and social capital, in this study, is also grounded on the theory of social-distance of school and community from the "open-door" position.

This study also revisits Perry's Neighborhood Unit Plan which conceptualized a neighborhood unit as a social entity with spatial boundaries (Keating and Krumholz, 2000) and the school's spatial centrality in the community. This planning concept is said to express the ideals of social reformers by "maintaining a constant interest in investing physical planning with expansive social purposes" (Silver, 1985). This unit has become one of the most widely discussed urban planning ideas (Silver, 1985). Thus, this idea can be a good practical theory within the field of urban planning to highlight the social and physical perspectives of school-community relations.

3.1.2 Conceptual Framework

Using such a theoretical foundation, this study is conceptualized based on two logical steps described as Phase I and Phase II (Figure 4); In Phase I, the relationship between school-community relations as behavior setting and parental social capital will be tested; and in Phase II, the association between school-community relations and children's walking-to-school, and the potential mediating effects of social capital will be assessed. Grounded in the evidence, other confounding factors will be considered including characteristics of the individual, school and community related to children's physical activity.

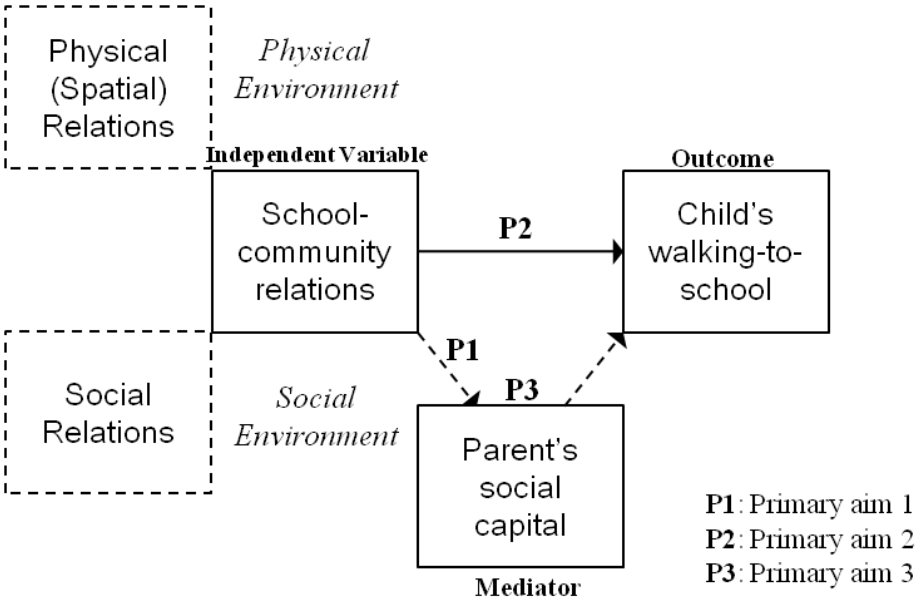


Figure 4

Conceptual Framework

3.2 RESEARCH AIMS AND HYPOTHESES

3.2.1 Research Aims

The primary aims of this study are:

- Primary Aim1 (P1): To assess the association between school-community relations and social capital among parents of school children [Phase I].
- Primary Aim2 (P2): To assess the relationship between school-community relations and children's walking to school behaviors [Phase II].
- Primary Aim3 (P3): To examine mediating roles of social capital on the relationship in P2 [Phase II].

Also as secondary aims, this study will (a) examine differences in school-community relations based on school characteristics and community environmental factors [Phase I]; (b) identify differences between objective versus perceived measurements of "a school's centrality in the community" using the spatial centrality index (Crucitti et al., 2006) and survey [Phase I]; and (c) examine relationships between joint-use programs of school facilities and children's walking-to-school behavior or physical activity [Phase II].

3.2.2 Hypotheses

Based on research aims, the following sections presents the tests of three primary hypotheses and three exploratory hypotheses:

- Primary Hypothesis 1.1 (H 1.1): School-community relations (both subjective and objective measures of centrality) will be associated with children's walking-to-school behaviors.
- Primary Hypothesis 1.2 (H 1.2): School-community relations will be associated with parent's social capital.
- Primary Hypothesis 1.3 (H 1.3): Parental social capital will mediate the relationship between school-community relations and children's walking-to-school behaviors.
- Exploratory Hypothesis 2.1 (H 2.1): The distinctive typology of school-community relations will be identified using spatial centrality indices and socio-environmental factors.

- Exploratory Hypothesis 2.2 (H 2.2): Objectively measured centrality (spatial centrality index) will be associated with the perceived centrality (survey) of the school in the community.
- Exploratory Hypothesis 3.1 (H 3.1): Recreational use of school facilities will be positively related to children's walking-to-school behaviors.

As research goals, this study will address gaps in knowledge of the physical and social relationships between schools and communities and their associations with children's walking to school behaviors. Findings from this study, while still in the exploratory stage, will provide policy guidelines for school siting and designing that respect the larger community context. Also, it will help decision-making processes in school attendance boundary delineation that seek to maximize walking potential for school children. In addition, it can highlight the role of joint-use programs at school on children's walking-to-school. This study's goal is to contribute to evidence-based knowledge for promoting healthy community design encouraging children to walk to school that draws support from mutually beneficial school-community relations.

3.3 RESEACH DESIGN

3.3.1 Setting and Population

Community can be defined as a social entity with a geographic boundary. This study focuses on school-community relationships with four dimensions of setting: (a) children and community members as the population setting, (b) walking-to-school as the physical activity setting, (c) school attendance boundary as the physical environment setting, and (d) social capital as the social environment setting (Figure 5).

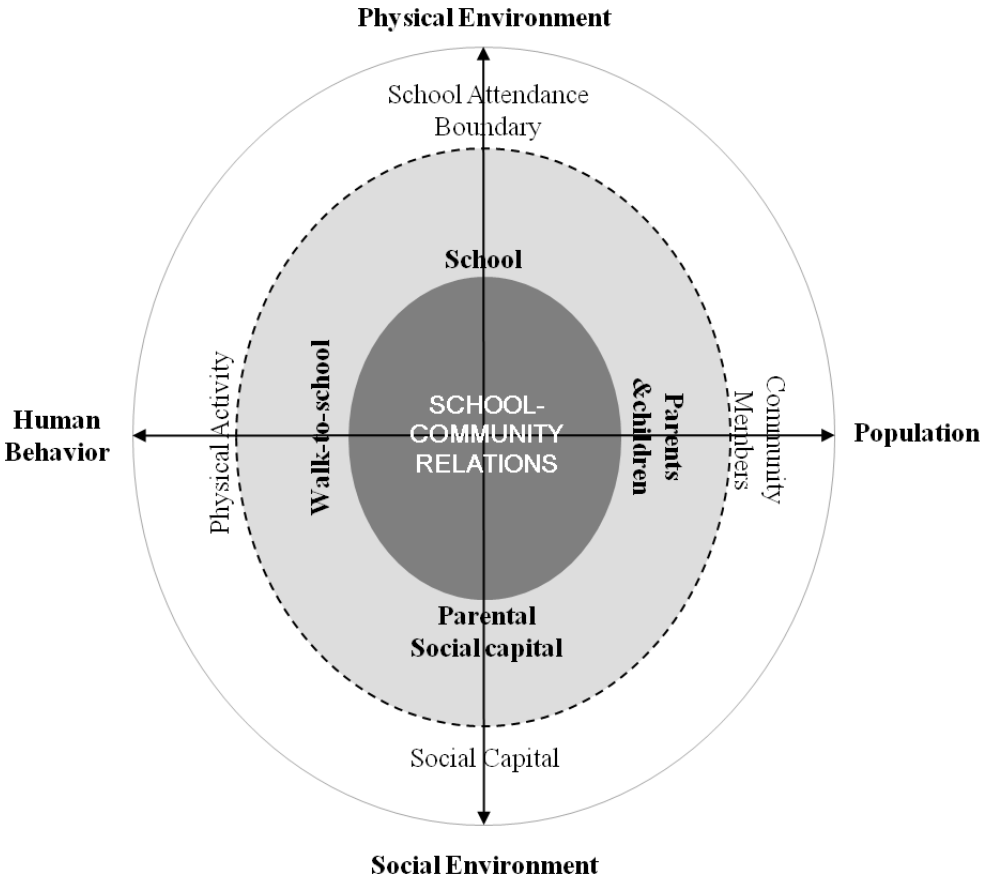


Figure 5

Conceptual Study Setting

This study utilizes the settings and target populations of the Safe Routes to School (SRTS) survey[8] conducted among children and families from 19 elementary schools in the Austin Independent School District (AISD) in Austin, Texas. Austin has recently experienced dynamic increases in urban development with rapid urban sprawl into suburban areas, and active infill developments in inner-city neighborhoods. Therefore, Austin is a good setting for this study to examine various school-community typologies and diverse socio-demographic characteristics that result from diverse development patterns such as those in Austin.

This setting includes 19 schools (with a total enrollment of 10,175) chosen from 78 schools in the AISD. A total of 4,626 surveys are completed, providing sufficient statistical power for the multivariate analyses proposed for this study.

The study schools mapped in GIS are presented in Figure 6 and the characteristics of study schools are provided in Table 6.

[8] The 2010 Safe Route School (SRTS) survey was conducted from May 2010 ~ June 2010 under the "Why"s and "Why Not"s of Active Living Research project (the "ALR project"), funded by the Robert Wood Johnson Foundation. The researcher of this dissertation is a research assistant with the ALR project, in charge of data collection and environmental assessments, and the PI of the ALR project is Chanam Lee, the academic advisor to this dissertation author.

The aims of the project are to examine multi-level natural and virtual experiments to identify specific interventions effective in promoting walking and physical activity and reducing obesity among high-risk groups of children. Among various measures embedded in this project, the SRTS survey captures overall behavior outcome variables and perceptual variables associated with children's physical activity and perceived physical environments related to walking-to-school.

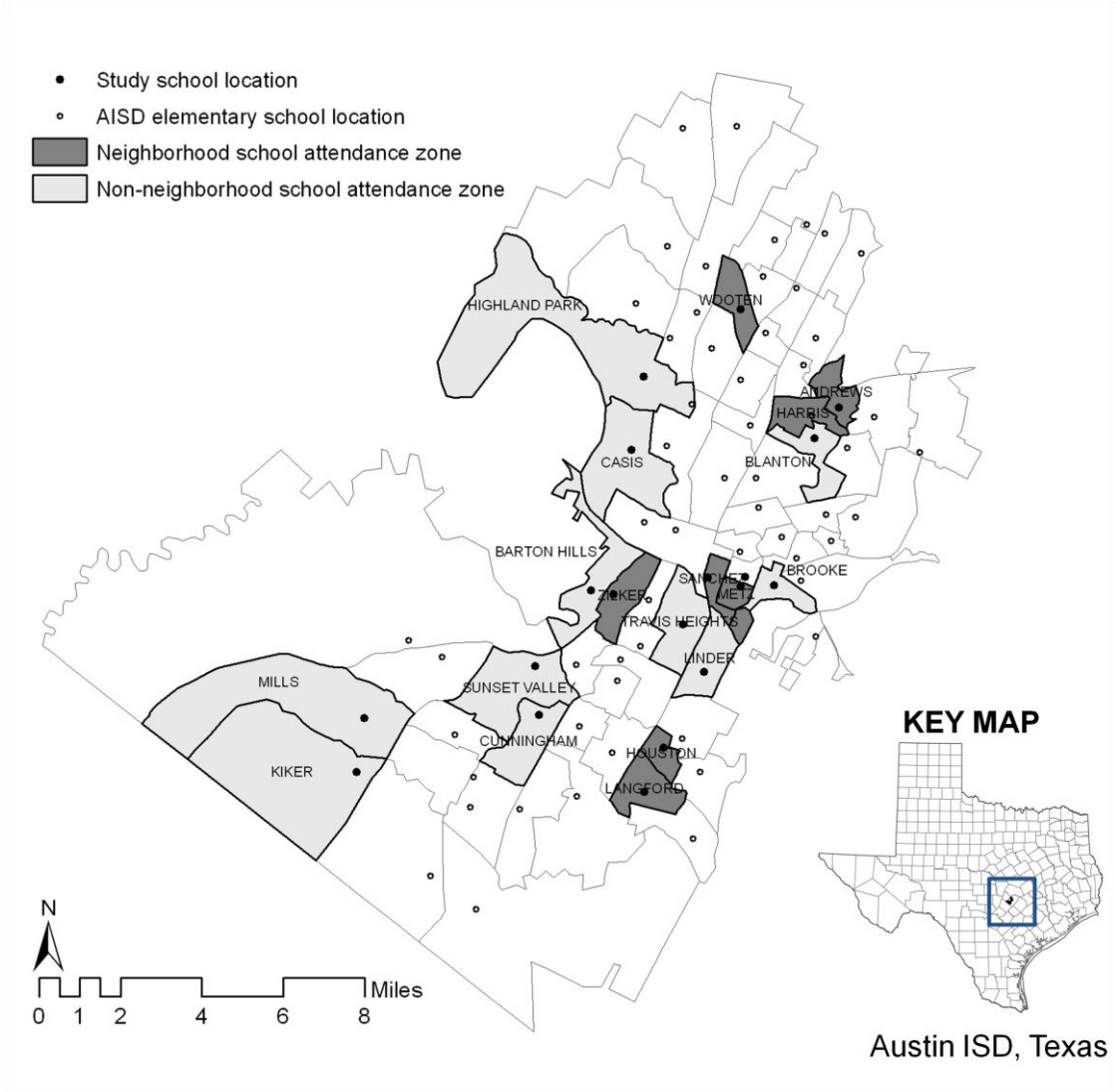


Figure 6

Study Area (AISD)

Table 6

Characteristics of Study Schools (selected variables only)

	Neighborhood School*								
`	Andrews	Harris	Houston	Langford	Metz	Sanchez	Wooten	Zilker	Total (mean)
School enrollment size	620	710	941	843	544	608	675	497	679.75
SRTS survey response rate (%)	49.8%	67.7%	26.8%	37.4%	34.8%	24.8%	46.0%	37.5%	40.60%
Walkers (%)	31.0%	60.1%	57.2%	65.4%	29.8%	14.4%	43.3%	27.2%	41.05%
Low-income** (%)	95.3%	96.9%	94.3%	95.0%	95.0%	95.9%	97.0%	39.0%	88.55%
Hispanic (%)	78.0%	84.7%	93.9%	92.7%	90.0%	92.3%	89.2%	31.1%	81.49%
Students living Within 1/2mile*** (%)	26.5%	39.8%	46.1%	43.1%	27.5%	28.6%	21.8%	29.7%	32.89%

Non-neighborhood School*										
Barton Hills	Blanton	Brooke	Casis	Cunningham	Highland Park	Kiker	Linder	Mills	Sunset Valley	Travis Heights	Total (mean)
372	536	410	829	537	600	711	877	1,058	443	564	630.64
20.8%	55.7%	30.0%	14.6%	22.1%	37.7%	27.5%	39.4%	25.3%	28.7%	30.1%	30.17%
29.5%	27.6%	22.6%	24.4%	18.7%	13.8%	20.9%	23.4%	29.9%	36.8%	27.2%	24.98%
13.2%	94.4%	96.1%	4.5%	62.8%	7.3%	3.5%	96.6%	8.7%	79.2%	75.7%	49.27%
9.1%	85.7%	93.4%	5.2%	50.4%	9.8%	10.0%	89.4%	18.8%	75.0%	61.2%	46.18%
17.6%	16.5%	26.1%	10.9%	19.1%	8.0%	10.6%	20.4%	21.3%	24.7%	18.2%	17.58%

Data source: Academic Excellence Indicator System, Texas Education Agency and the ALR research

* Neighborhood school and non-neighborhood school are defined at Section 4 in this study.

** Refers to '% of economically disadvantaged students' who are eligible for free/reduced-price lunch or other public assistance.

*** Refers to the approximate distance from the Texas Capitol "as the crow flies".

3.3.2 Measurement Model

This cross-sectional study will focus on (a) the association between school-community relations and social capital [Phase I], (b) the relationship between school-community relations and children's walking-to-school behavior [Phase II], and (c) the mediating effects of social capital in [Phase II]. This study will focus on children and parents from 19 elementary schools in the Austin Independent School District (AISD) in Texas.

The study model based on the conceptual basis described above consists of a set of independent variables (objectively and subjectively measured school-community relations), dependent variables (children's walking-to-school behavior) and mediators (subjective parental social capital level) (Figure 7). This model considers two phases to respond to the primary aims (P1, P2 and P3) and alternative models will also be tested using path analysis to specifically assess the mediating effect. In addition, the intermediate outcomes about the relationship (a) between physical and perceived school-community relations; and (b) between children's recreational uses of school facilities and their walking-to-school behaviors are assessed.

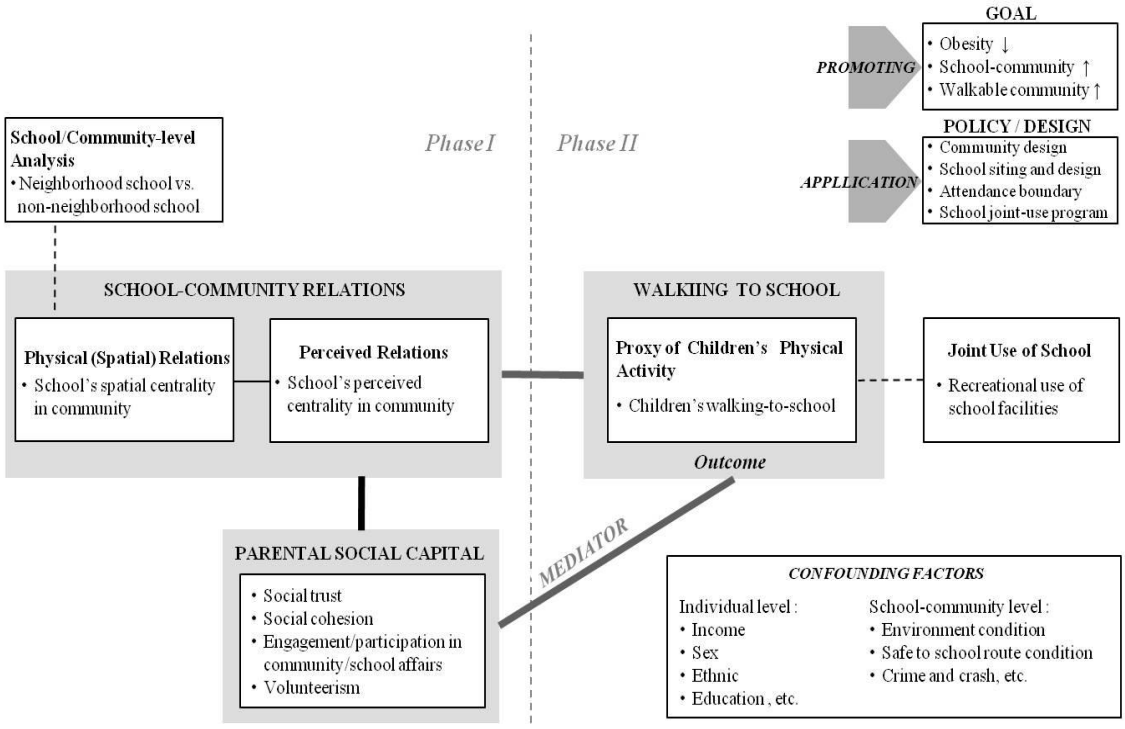


Figure 7

Measurement Model

3.4 MEASUREMENT STRATEGIES

This study uses both objectively and subjectively measured data on personal, socio-demographic, physical environmental factors that may be associated with school-community relations and children's walking to school behaviors. These data are collected by the Safe Routes to School (SRTS) survey, with additional follow-up Parental Social Capital Survey and a GIS dataset from the City of Austin.

3.4.1 Objective Measures

3.4.1.1 School's Spatial Centrality

To quantify physical school-community relations objectively, multiple spatial centrality indices are employed to assess each individual elementary school's structural centrality in the urban network of its attendance area. "Centrality" has been considered a fundamental concept in network analysis since its introduction in structural sociology fields. It assumes that more central parts of the networks are more likely to have high frequency of experiencing and knowing the routes (Tversky, 1993; Crucitti et al., 2006; Tomko et al., 2008).

The spatial centrality is based on the spatial network analysis theory which is a spatial knowledge about the hierarchical organization of places and routes in urban spaces. Among many measures for experiential network analysis in urban spaces (Hillier and Hanson, 1984; Bera and Claramunt, 2003; Claramunt and Winter, 2007; Crucitti et al., 2006), spatial centrality measures are selected for this study as it is most applicable to school-community relations regarding children's walk-to-school routes because it accounts for relational (topological) networks and spatial attributes such as distance captured by network nodes (intersections) and edges (streets).

Among various types of centrality indices (Claramunt and Winter, 2007; Crucitti et al., 2006; Tomko et al., 2008) (Table 7), this study utilizes *closeness centrality* C^C which measures the average length of the shortest paths to all other nodes (d_{ij}) in the graph and *betweeness centrality* B^c which measures the average ratio of the shortest routes on the node lies (Wasserman and Faust, 1994; Tomko et al., 2008) because the

shortest distance is one of the most significant barriers to school transportation (EPA, 2003; Boarnet et al., 2005).

Table 7

Spatial Centrality Indices

Index	Formula	Descriptions
Used in this study:		
Closeness Centrality C^C	$C_i^C = \frac{N-1}{\sum_{j \in G, j \neq i} d_{ij}}$ d_{ij} : The shortest path length between *i* and *j*	- A measure reflecting the average length of the shortest paths to all other nodes of the graph; - High closeness centrality has low average length of the path to all other nodes in the graph. - Reflecting the global structure of the city with revealing its core.
Betweenness Centrality C^B	$C_i^B = \frac{1}{(N-1)(N-2)} \sum_{j,k \in G, j \neq k \neq i} \frac{n_{jk}(i)}{n_{jk}}$ n_{jk} : The number of shortest paths between *j* and *k*	- Providing the means to quantify the likelihood a graph node will lie on a shortest path between two other nodes of the graph. - The probability of being selected by a frequent way-finder.
Other indices:		
Degree Centrality C^D	$C_i^D = \frac{\sum_{j=1,N} a_{ij}}{N-1} = \frac{k_i}{N-1}$ k_i : The degree of node *i* (the number of nodes adjacent to *i*)	- In space syntax, called 'connectivity': - A local measure specifying the number of direct neighbors of a node in a network.
Straightness Centrality C^S	$C_i^S = \frac{1}{N-1} \sum_{j \in G, j \neq i} \frac{d_{ij}^{Eucl}}{d_{ij}}$ d_{ij}^{Eucl} : The Euclidean distance between *i* and *j* along a straight line	- A measure capturing to which extent the connecting route between nodes *i* and *j* deviates from the virtual straight route.
Information Centrality C^I	$C_i^I = \frac{\Delta E}{E} = \frac{E[G] - E[G']}{E[G]}$, Where $E[G] = \frac{1}{N(N-1)} \sum_{i,j \in G, i \neq j} \frac{d_{ij}^{Eucl}}{d_{ij}}$ G' : The graph with *N* nodes and *K–ki* paths obtained by removing from the original graph *G* the paths incident in node *i* $E[G]$: the efficiency of a graph *G*	- A measure the centrality of node *i* defined as the relative drop in the network efficiency E[G] caused by the removal from G of the paths incident in *i* - Reflecting the ability of the network to respond to the deactivation of the nodes

Cited from Crucitti et al.(2006) and Tomko et al. (2008).

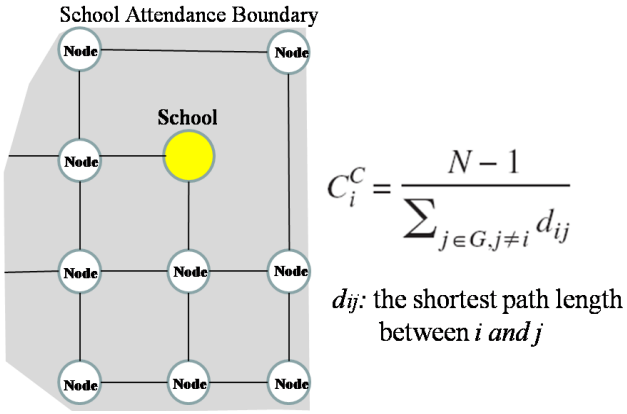


Figure 8

School's Spatial Centrality Concept (*Closeness Centrality*)

The initial standard global measures of centrality used in social networks are *closeness centrality* and *betweenness centrality* (Bonacich, 1987). *Closeness centrality* and *betweeness centrality* are respectively called integration and global choice in the space syntax school (Claramunt and Winter, 2007). The output index can be exported to GIS to construct spatial graphs of specific school-community relations by giving each node a hierarchical ranking in the urban network.

There are several processes to measure spatial centrality indices for this study. First, the real nodes[9] within each attendance boundary are selected and the node-to-node distances are calculated using Point & Polyline Tools v.1.2 which is an extention for ArcView 3.0.a. Second, these distances are summed-up and averaged for each node using Microsoft Office Access 2007. The outcome index values are exported into ArcGIS 9.3 and SPSS dataset for spatial mapping and further analysis (Figure 9).

[9] The real node is a GIS term which is distinctive from the dangle mode (a dead-end point of street) or the vertex (not intersection but a point on a street). The real node is a street intersection which connects more than three streets on the map. Point & Polyline Tools v.1.2 supports the extraction of real nodes from all street points.

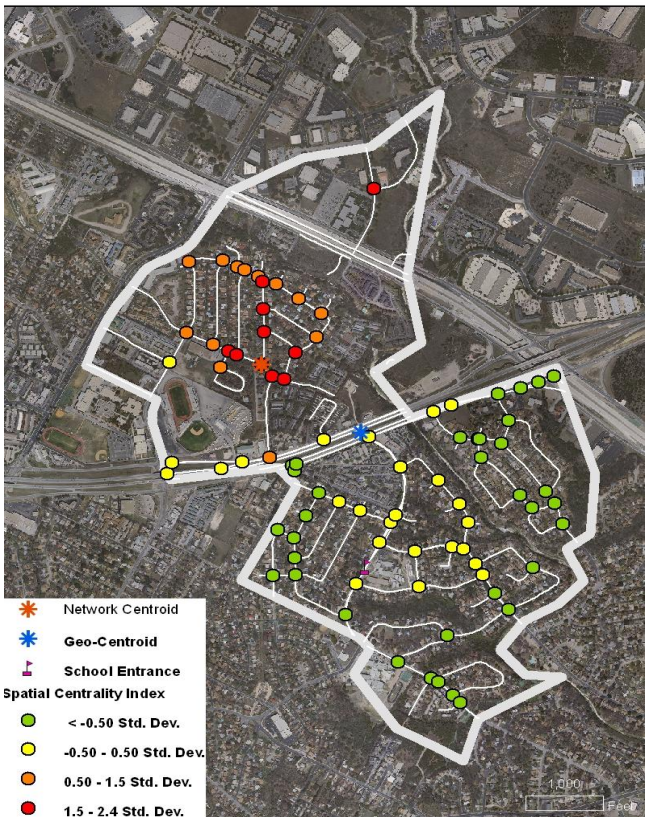


Figure 9

School's Spatial Centrality in GIS (*Closeness Centrality*)

In addition to such spatial centrality indices, this study also employs the concept of the geographical centrality by using the Euclidean (airline) distance from the school to the geographical centroid of each attendance area for comparison with data from the spatial centrality indices. Also, people's perceived centrality of the school from the survey will be compared with those objectively measured.

3.4.1.2 GIS Measures

Most GIS data that will be used in this proposed effort have been collected by the ALR project and other previous projects including detailed land use and housing

information, transportation data (traffic volume, number of lanes, traffic speed, intersection, crosswalks) and safety (locations of crime and traffic crashes).

To analyze school-community design factors, a 1/2 mile buffer from the school is used as the primary spatial analysis unit. A 1/2 mile buffer is consistent with the "school service sphere (children's walking distance)" in Perry's Neighborhood Unit Plan (Perry, 1929), the maximum walkable distance between home and school (Levin, 1966), the walking ability level in health-related studies (Hakim et al., 1998) and the mean distance of children's walking-to-school from the SRTS survey. This GIS analysis identifies the differences of each paired school-community setting. Buffer analysis provided by ArcGIS 9.3 is used for assessing the physical characteristics of each school-community setting and for visualizing the key findings of this study.

3.4.2 Subjective Measures

3.4.2.1 Parental Safe Routes to School (SRTS) Survey

The SRTS survey instrument developed by the ALR research includes overall behavior outcome variables and perceptual variables associated with children's physical activity and perceived physical environments related to walking-to-school. It also captures the children's typical travel mode to school, parent's and children's personal factors as well as household factors. The survey includes additional measures specifically needed for this research, including parent's perceptions about school-community relations ("What do you think is the center of your neighborhood?") and civic engagement ("In the past year, did any of the following events or activities take place in your children's school or the neighborhood your family lives in?").

3.4.2.2 Parental Social Capital Survey

This follow-up Parental Social Capital Survey is conducted among sub-groups of parents who agreed to participate in a future study (recruited from the SRTS survey). Parents in this study also include other guardians who can make decisions about children's walking to school. Even if this survey includes school facility/park uses and social perceptions of parents, measuring the detailed social capital level is the primary focus.

Various measures of social capital have been introduced since Coleman (1988) developing ways of utilizing it for empirical research purposes (Harper, 2001). Although no agreement exists on the standard measures, most published studies use social trust, social networks, social cohesion, civic participation, reciprocity, neighborhood connection and volunteerism as common indictors (Hall, 1999; Spellerberg, 1997; Putnam, 2000; Blaxter et al., 2001; Green et al., 2000). Also, these 5-themes can be classified into two classes: social input and social outcome (Table 8).

Table 8

Common Indicators of Social Capital

Indicators	Social Input			Social Outcome	
	Social Trust	Social Cohesion/network	Informal Sociability	Civic Engagement	Volunteerism
Hall (1999)		●	●		
Spellerberg (1997)		●		●	
Green et al (2000)	●			●	
Putnam (2000)	●	●	●	●	●
Blaxter et al (2001)	●	●	●	●	●

This study utilizes Putnam's (2000) 5-theme instruments which brought national attention and focuses to both individual and community level measurements of social capital. This study also includes additional new items to capture school-specific social capital. Based on Putnam's and other relevant constructs, the follow-up survey is constructed to measure parent's level of social trust, social cohesion/network, civic engagement, volunteerism and informal sociability especially related to community and school affairs. The SRTS survey also includes a few items about social cohesion and civic engagement as representatives of social input and social outcome respectively.

3.4.2.3 Survey Methods

Safe Routes to School (SRTS) Survey

With a great support of the City of Austin, the survey instruments are delivered to parents via children's weekly portfolio from each school, and collected by teachers from May 2010 through June 2010. The survey is developed after several rounds of pre-tests, feed-backs and translation consistency checks (in English and Spanish). A total 4,626 parents returned the completed surveys the out of total 13,573 students from 19 elementary schools in Austin Independent School District (AISD) [10], which has a sufficient statistical power (34.08 % of sample frame). Data is coded using the Cardiff Teleform™ software that allows for semi-automated data entry using its scanning platform to reduce coding error that may occur in a manual coding process.

[10] Data was collected from 2009-2010 Academic Excellence Indicator System, Texas Education Agency (http://www.tea.state.tx.us/perfreport/aeis/2010/index.html)

Parental Social Capital Survey

Built on the large sample size of the SRTS survey, this survey is conducted from May 2011 through June 2011 with all parents who said yes to the recruitment question and provided contact information. Major items are employed from validated existing instrument including Putnam's (2000) with appropriate tests of concurrent validity, known group validity or factorial validity[11].

Both telephone and email survey methods are used in order to (a) increase response rates based on "social exchange theory" that encourage simple and articulate communication with the respondents to reduce avoidance (Dillman, 2000), (b) minimize the time term between the SRTS survey, and (c) allow for contacting those participants who provide only telephone numbers or email address. Also, additional efforts are made by keeping the questionnaire short, selecting an optimal time (5 minutes) for contacts, incentives, and following up by emailing a reminder or calling-back.

Among total recruitments from the SRTS survey (1,623 recruits out of a total of 4,626), the number of participants is 237 (161 from a telephone survey and 76 from an email survey). The response rate is 14.60%. This low response rate may be a concern about the indication of the social capital level of the community. By comparing the preliminary social capital variables of the SRTS survey regarding social capital, some complementary views are needed in the individual-level analysis.

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[11] First, concurrent validity is to assess a measure of how well a particular test correlates with a previously validated measure. Second, known groups validity is to test if certain specified groups score differently from other groups by evaluating the test's ability to discriminate between the groups based on the groups demonstrating different mean scores on the test. Last, factorial validity is established through factor analysis which is a set of mathematical procedures for analyzing the relationships among a set of items to reveal the underlying dimensions or constructs explaining relations among the hypothetical variables (Trochim, 2006).

3.5 CONSTRUCT

In sum, the overall study construct and variables are provided in Table 9:

Table 9

Study Construct

Construct					Analysis Level		
Variable		Description	Type	† Source	School level	Individual level	
						Full data	Sub-group
Children's Walking to School Behaviors							
Walking-to-school	Outcome		Binary	SRTS	●	●	●
School-Community Relation							
Closeness centrality	Ind.	School's spatial centrality index (1)	Conti.	GIS	●	●	
Betweenness centrality	Ind.	School's spatial centrality index (2)	Conti.	GIS	●	●	
Geographical centrality	Ind.	Distance from geographical centroid	Conti.	GIS	●	●	
Perceived centrality	Ind.	Is school the center of your neighborhood? (1:yes, 0:no)	Conti.	SRTS	●	●	
Parental Social Capital							
Volunteerism	Med./ Ind. Dep.*	Volunteer at school (1:yes, 0:no)	Binary	SRTS	●	●	
Social cohesion	Med./ Ind./Dep,	Feel connected (1:very unlikely-5:very likely / 1:yes, 0:no)	Ordinal Binary	SRTS	●	●	
Social trust	Ind.	Feel trusted from neighborhood people (1:very unlikely-5:very likely)	Ordinal	PSC			●
Social honesty	Ind.	Feel honest from neighborhood people (1:very unlikely-5:very likely)	Ordinal	PSC			●
Informal sociability	Ind.	How often visit neighborhood (1:very unlikely-5:very likely)	Ordinal	PSC			●
Engagement in public affair	Ind.	Vote in an election (1:yes, 0:no)	Binary	PSC			●
Community/organizational life	Ind.	Served in any community organization (1:yes, 0:no)	Binary	PSC			●
School board volunteerism	Ind.	Attended a school board meeting (1:yes, 0:no)	Binary	PSC			●
School affair volunteerism	Ind.	Volunteer at school (1:yes, 0:no)	Binary	PSC			●
School Facility Joint-Use (Exploratory)							
Recreational joint use	Ind.	Used school facility for recreational purpose (1:yes, 0:no)	Binary	PSC			●
Frequency of joint use	Ind.	How often use per month	Conti.	PSC			●

† SRTS is Safe Route to School survey and PSC is Parental Social Capital survey.

* 'Ind.' is independent variable; 'Dep.' is dependent variable;'Med.' is mediator variable; and 'Conti' is continuous variable.

Table 9 (Continued)

Construct					Analysis Level		
Factor		Variable	Type	Source †	School level	Individual level: Full data	Individual level: Sub-group
School-level Variables							
Socioeconomic Factor		Hispanic students Economically disadvantaged Student enrollment	Conti.	AEIS	●		
Environmental Factor		Population density Street density Street intersection density Land-use mix High-speed street density Crash rate Crime per year	Conti.	GIS	●		
Individual-level Factors							
Socio-demographic Factor	Ind.	Child's gender Child's grade Child / parent's ethnicity Parent's education Parent's immigrant status Special lunch program Length of residence # of siblings Health insurance Car ownership Grocery shopping Pet ownership Child's BMI	Conti. Ordinal Binary	SRTS		●	●
Perceptual Barrier and Attitude	Ind.	Safety concerns Negative attitude Positive peer influence	Ordinal	SRTS		●	●
Environmental Factor	Ind.	Environmental barrier Presence of sidewalk Sidewalk condition Neighborhood environmental quality	Binary Ordinal	SRTS		●	●
School Transportation Factor	Ind.	Actual distance (home-to-school) Perceptual distance (home-to-school) School bus service Walking with adults	Conti. Ordinal Binary	SRTS		●	●

† SRTS is Safe Routes to School survey and PSC is Parental Social Capital survey.
* 'Ind.' is independent variable; 'Dep.' is dependent variable and 'Med.' is mediator variable.
'Conti' is continuous variable.

4. SCHOOL/COMMUNITY-LEVEL ANALYSIS: NEIGHBORHOOD SCHOOLS VS. NON-NEIGHBORHOOD SCHOOLS

4.1 INTRODUCTION

A neighborhood school is often defined as a community-centered school which has a smaller and walkable attendance boundary (McDonald, 2010, Sharp, 2008). In spite of having once been an American icon, nowadays, such small neighborhood schools are disappearing remained with only a small portion of walkers-to-school (Beaumont and Pianca, 2002). Thus, it is important to re-access the significance of neighborhood schools and its community settings.

This cross-sectional study examines the associations between school-community relations, social capital and walking-to-school behavior based on the diverse dimensions of neighborhood school-community's characteristics against the characteristics of a non-neighborhood school. The study area includes 19 public elementary schools and their communities, the attendance areas in AISD, which are the SRTS survey targets. Also, 73 public elementary schools out of all 78 schools in AISD are included in this study for neighborhood school selection and data comparisons.

4.2 OBJECTIVES

"School-community relations" in this study is captured as "school's centrality" in the community (the attendance boundary) and social capital is indicated by two items,

"social cohesion" and "volunteerism". This section examines the tests for two explanatory hypotheses of this study:

- Hypothesis 2.1 (H 2.1): The distinctive typology of school-community relations will be identified using spatial centrality indices and socio-environmental factors.
- Hypothesis 2.2 (H 2.2): Objectively measured centrality (spatial centrality index) will be associated with the perceived centrality (survey) of the school in the community.

4.3 METHODS

4.3.1 Defining and Selecting Neighborhood Schools

Even though there is no universal definition of a neighborhood school, a "neighborhood school" is mostly understood and defined based on the potential of children's being able to walk to school along with the proper size of a geographical service area (school attendance boundary) of school (Table 10).

Therefore, this study defines "neighborhood school" as a "public school having (a) smaller attendance district and (b) higher geographical possibility of children's walking-to-school" as the number of students living within walking distance of the school. This definition of "neighborhood school" is a relative term which implies a relation to a "non-neighborhood school" which has a relatively larger attendance boundary and less students living within walking distance to the school. According to such a definition scheme, neighborhood schools can be defined differently depending on the city and region. Also, the median values are used instead of the mean for separating

neighborhood schools from non-neighborhood schools in AISD, because of outliers in attendance area sizes.

Table 10

Definitions of Neighborhood School

Author (Year)	Definition
Council of Educational Facility Planners, International & U.S. Environmental Protection Agency (2004)	"A community [neighborhood] school is relatively **small** and located **within the neighborhood** it serves."
Austin Independent School District (2007)	"A neighborhood school typically is one that is associated with a particular community, **can be walked to**, and serves as a center of community."
National Trust for Historic Preservation (2008)	"A community-centered [neighborhood] school is located near the families it serves, allowing students **to walk or bike to school** and frequent interactions between students, teachers, and parents."
McDonald (2010)	"…the establishment of **small**, neighborhood schools **within walking distance** of their students…"
Sharp (2008)	"[A neighborhood school is] **small**, . . . integrated into the community fabric, . . . and . . . located within the neighborhoods they serve"
School Choice For Kids by Independence Institute (2011)	"[A neighborhood school is] a public school students are assigned to attend because they **live in the school's attendance area** or attendance zone."
Education.com (2011)	"[Neighborhood schools are] schools in which most or all of the student population comes from **the immediate geographic area** in which the school is located."

The two variables used to select neighborhood schools are (a) area of attendance boundary and (b) the percent of students living within a ½ mile distance (walking distance) from the school. The actual area suggested by Perry's Neighborhood Unit (¼ mile radius) is considered as a selection criteria, but excluded because no school in our study setting met the criteria. With these two variables, neighborhood schools are

selected when the attendance zone area is smaller than the median of 73 AISD schools and the percent of students living within a ½ mile distance is equal to or greater than the overall median (Table 11). In this study, schools refer to public elementary school, and community refers to the school attendance area.

Table 11

Variables Considered for Selecting Neighborhood Schools

Variable	Definition	Sample Size (schools)	Neighborhood School Selection	Median	Std. Deviation
Perry's boundary (mile^2)	Area with a ¼ mile-radius ($A = \pi r^2$)	73	Not applicable	0.196	
Attendance area (mile^2)	Area of attendance boundary	73	< Median	1.740	5.355 Max:41.511 Min:0.356
Students living walkable distance (%)	% of students living within a ½ mile distance from school	73	≥ Median	21.3	15.6 Max:73.3 Min: 0.8

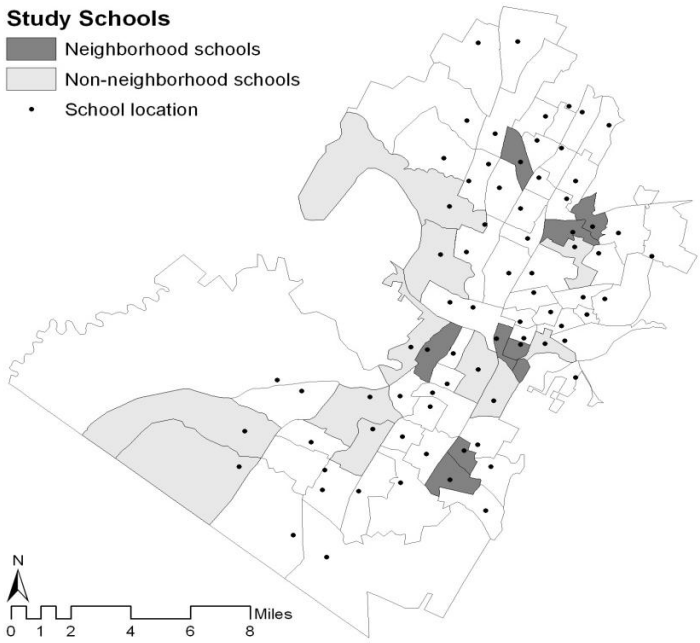

Figure 10

Neighborhood Schools and Non-neighborhood Schools

Accordingly, 20 of the 73 AISD schools are selected as neighborhood schools; among the 19 study schools, eight are considered as neighborhood schools (Figure 10). These eight schools include Andrews, Harris, Houston, Langford, Metz, Sanchez, Wooten, and Zilker Elementary schools, which have larger number of walkers (Mean=40.9%) than non-neighborhood schools (Mean=25.1%) and are more likely to have the Safe Routes to School program (7 out of 8 schools) than non-neighborhood schools (1 out of 11 schools) (Table 12).

Table 12

Neighborhood Schools and Non-neighborhood Schools Characteristics [a]

	Schools	Walkers (%)	Attendance area ($mile^2$)	History (year)	Size (Enrollment)	SRTS program	Park adjacency	Community Education program
Neighborhood School (8)	Andrews	0.31	1.029	49	620	●		●
	Harris	0.60	1.214	57	710	●		
	Houston	0.57	0.737	34	941	●		●
	Langford	0.65	1.593	31	843	●		
	Metz	0.30	0.817	19	544	●		
	Sanchez	0.14	0.629	35	608	●		●
	Wooten	0.43	1.264	57	675	●	●	
	Zilker	0.27	1.558	61	497		●	
Non-neighborhood School (11)	Barton Hills	0.30	2.673	47	372			●
	Blanton	0.28	1.455	47	536	●		●
	Brooke	0.23	0.997	57	410			●
	Casis	0.24	4.106	60	829			●
	Cunningham	0.19	2.092	49	537			●
	Highland Park	0.14	10.535	59	600		●	
	Kiker	0.21	9.825	19	711			●
	Linder	0.23	1.791	39	877		●	
	Mills	0.30	9.089	13	1058			
	Sunset Valley	0.37	3.794	40	443		●	
	Travis Heights	0.27	2.312	73	564		●	

[a] School-community-level data are collected by SRTS survey (walkers), GIS (area and park adjacency), Texas Education Agency (enrollment) and AISD website (history, SRTS program and community program).

4.3.2 Measuring School-Community Relations

This study use "school centrality" as the indicator of school-community relation measurements. The spatial relationships between school and community measured in this study explain how the given attendance zone works as a school's service sphere. Among various measures, this study uses four measures of a school's centrality in the community: (a) closeness centrality and (b) betweenness centrality, (c) geographical centrality which is the distance from geographical centroid, and (d) school's perceived centrality as a neighborhood center (Figure 11).

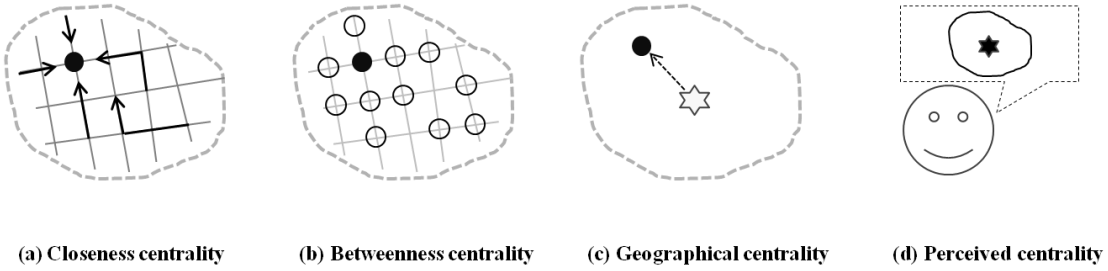

Figure 11

Measurements of School's Centrality

Closeness centrality and *betweenness centrality*: These two objective measures of a school's centrality have a similar structural measure but a different understanding of space and path. A higher closeness centrality value of the school node indicates the school can be reached from other street nodes with relatively shorter distances. And a higher betweenness centrality value of the school node indicates that school lies on a larger number of other shortest paths. ArcGIS 9.3 and Microsoft Access 2007 are used for these measurements.

Geographical centrality: As another objective measure of a school's centrality, a short distance from the geographical centroid is used to measure how far the school is located from the geographical center of the school's attendance area by using GIS.

Perceived centrality: A high perceived centrality value indicates that a large number of people within the community regard their child's school as the center of the neighborhood. This concept is based on the assumption that measures of actor's network centrality are derived from an elementary process model of social influence (Friedkin, 1991) and street network might influence social networks because the perceived centrality of people might reflect the social role of the school in their neighborhood in terms of social networks (Table 13). The parental SRTS survey is used for this measurement.

Table 13

Variables of School's Centrality

Variable	Definition and Measurement	Sample Size (schools)	Median (Mean)	Std. Deviation
Objective Centrality				
Closeness Centrality	The inverse sum of the shortest routes of school's node (*i*) to every other node in the attendance boundary $C_i^C = \frac{1}{\sum_{j \in G, j \neq i} d_{ij}}$	19	0.007 (0.118)	0.011
Betweenness Centrality	The ratio of shortest routes on which school's node (*i*) lies in the attendance boundary $C_i^B = \sum_{j,k \in G, j \neq k \neq i} \frac{n_{jk}(i)}{n_{jk}}$	19	0.005 (0.005)	0.004
Geographical Centrality (mile)	Distance from the school to the geographical centroid of the attendance area	19	0.358 (0.633)	0.661
Subjective Centrality				
Perceived Centrality (%)	The percentage of respondents who think their children's elementary school is the center of their neighborhood (Question: "what is the center of your neighborhood?")	19	53.3 (53.4)	12.9

4.3.3 Measuring Parental Social Capital

This study utilizes two themes of social capital: volunteerism and social cohesion. These are measured in the parental SRTS survey with two questions: "Have you volunteered at your child's school (e.g. PTA, PTO, SHAC, library, cafeteria monitor, classroom assistant) in the past 12 months? (Yes=1/No=0)" and "I feel connected to people in my neighborhood (measured with a 5-point Likert type scale; 1 being strongly disagree and 5 being strongly agree)". Mean values of these two questions for each school are used for analysis.

4.3.4 Measuring Environmental and Socio-Economic Factors

Environmental factors are mostly measured by utilizing the secondary data (Zhu, 2009) and GIS data provided by the City of Austin and AISD. ArcGIS 9.3 is used for this measurement and spatial unit is the school attendance boundary. Environmental measures for the school-community include population density (population per area), street intersection density (# of intersections per acre), land use mix (evenness of distribution based on square footage of residential, commercial and office uses)[12], high-speed, high-speed street (% of streets with >30mph posted speed limit), crash rate (# of all crashes/mile/ year)[13] and crime rate (# of all crimes/100 acres/year)[14].

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[12] (–1) × [(area of R/total area of R, C, and O) × ln (area of R/total area of R, C, and O) + (area of C/total area of R, C, and O) × ln (area of C/total area of R, C, and O) + (area of O/total area of R, C, and O) × ln (area of O/total area of R, C, and O)]/ln(number of land uses present); when R is residential, C is commercial and O is office (adopted from the Strategies for Metropolitan Atlanta's Regional Transportation and Air Quality study in 2005) (Frank et al, 2005).

[13] Crash data uses geo-coded GIS data for crashes (2002- 2006), including automobile–automobile, automobile–bike, and automobile–pedestrian crashes in the City of Austin (City of Austin, 2006).

[14] Crime data utilizes geo-coded GIS data of major index crimes (2005-2006) including homicide, forcible rape, robbery, aggravated assault, burglary, larceny–theft, motor vehicle theft, and arson (City of Austin, 2006).

Socio-economic factors are measured based on the school-level data provided by Texas Education Agency. The factors include ethnicity (% of Hispanic students), income (% of economically disadvantaged students[15]) and school size (total enrollment).

4.3.5 Data Analysis

In order to compare between different centrality indices including closeness centrality, betweenness centrality, geographical centrality and perceived centrality, Pearson's correlation (*r*) measure are employed. The value of Pearson's *r* falls between 0 (no correlation) and ±1 (perfect positive or negative correlation). The analyses of variance (ANOVAs) are conducted to examine the mean differences in the level of children's walking-to-school, school-community relations (school's centrality), social capital level, environmental status and socioeconomic status between neighborhood schools and non-neighborhood schools. Along with these ANOVAs, as the school-level sample size is small (N=19) with a weak assumption of normality, the Kruskal Wallis test is employed for the nonparametric test.

4.4 RESULTS

4.4.1 Differences between School's Centrality Measures

According to Pearson's correlations (*r*) among the four centrality measures of school-community relations, *closeness centrality* is highly correlated with *betweenness*

[15] Texas Education Agency defined students as "economically disadvantaged" if they receive free or reduced-price school lunches, or if they qualify for other public assistance. Students are eligible for reduced-price lunches (at a cost to the student of 40 cents) if their household income is less than 185% of the federal poverty level; and students are eligible for free lunches if their household income is less than 130% of the federal poverty level. This study regards both eligibilities as a low-income level (Texas Education Agency, 2011).

centrality (r = 0.954) at the 0.01 level; this means how quickly the school can be reached from other places is highly correlated with how much the school connects to those places. Also, *betweenness centrality* is negatively correlated with the distance from the geographical centroid of the attendance district (r = -0.428) at the 0.1 level of significance; the higher *betweenness centrality* is moderately correlated with the shorter distance between the school and the geographical center of the attendance zone (Table 14).

However, the perceived centrality does not show significant correlations with any other centrality measures. This finding suggests that the perceived school's centrality is different from the objectively measured school's spatial centrality (Table 14).

Table 14

Correlations among Centrality Measures

Centrality Indices	Correlation Coefficient	1	2	3	4
1. Closeness Centrality	Pearson's *r*	1.000			
	Sig. (2-tailed)	-			
	N	19			
2. Betweenness Centrality	Pearson's *r*	**0.954*****	1.000		
	Sig. (2-tailed)	0.000	-		
	N	19	19		
3. Geographical Centrality	Pearson's *r*	-0.378	**- 0.428***	1.000	
	Sig. (2-tailed)	0.110	0.067	-	
	N	19	19	19	
4. Perceived Centrality	Pearson's *r*	0.097	0.226	-0.160	1.000
	Sig. (2-tailed)	0.693	0.351	0.512	-
	N	19	19	19	19

* p <0.1, ** p <0.05 and *** p <0.01

GIS mapping of these centrality indices are presented in Figure 12. Overall, smaller attendance zones show stronger spatial centrality patterns (darker colors) among

three spatial centrality measures including closeness centrality, betweeness centrality and geographical centrality, but the perceived centrality does not show a similar pattern as other spatial centrality indices.

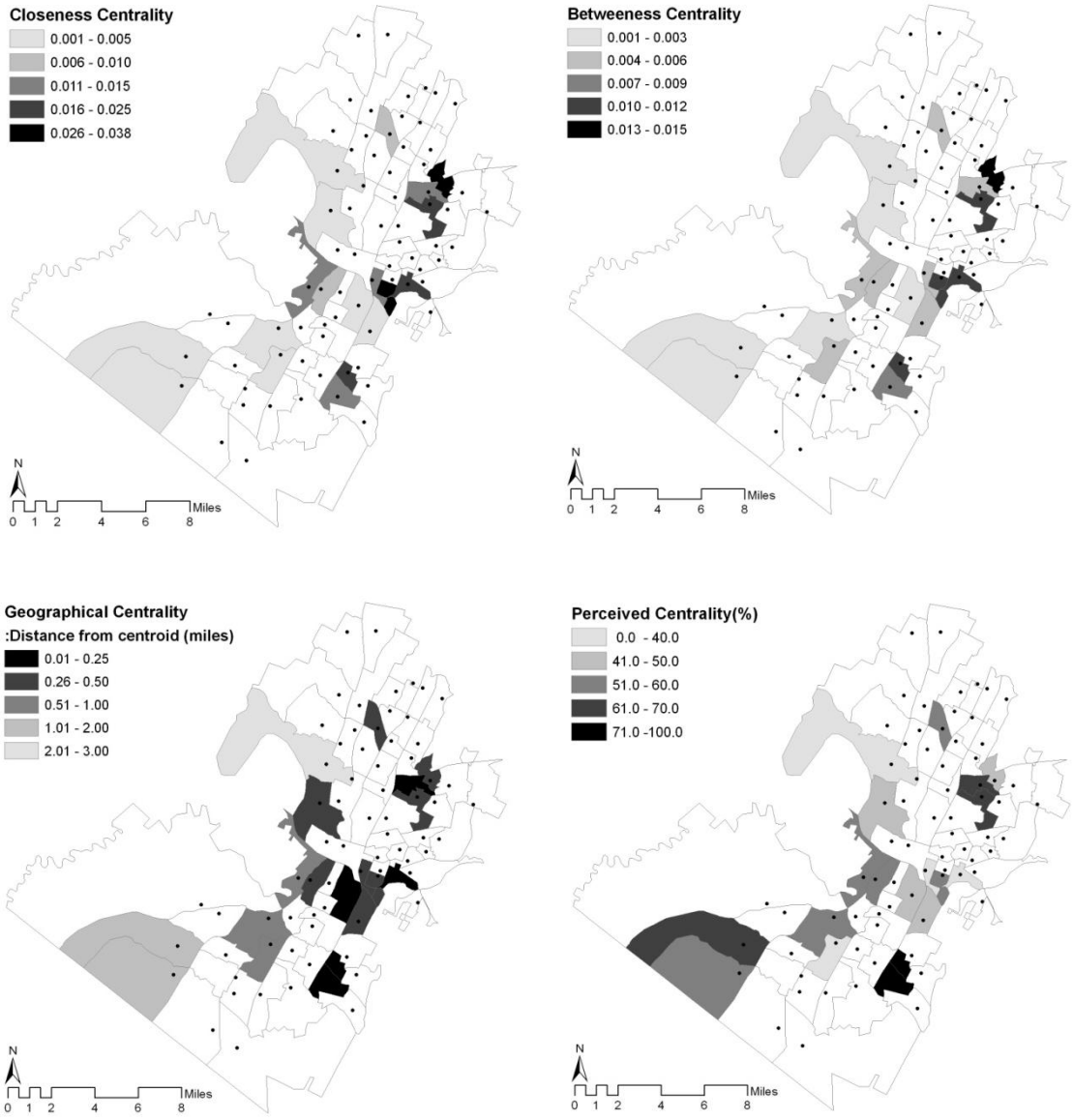

Figure 12

Centrality Measures in GIS

4.4.2 Mean Differences: Neighborhood and Non-neighborhood Schools

Due to the small sample size (N=19) of study schools, a non-parametric Kruskal-Wallis test, which does not assume a normal distribution, is used along with ANOVAs. SPSS 17.0 is used as the statistical software for this test. As shown in Table 15, the results from Kruskal-Wallis test look mostly consistent with the ANOVA results except for several cases, such as "perceived centrality", "volunteerism" and "crash rate".

According to the results, significant mean differences are observed in walking level, school's centrality (school-community relations), volunteering at school (social capital), ethnicity, income, population density, transportation conditions (street intersection density and % of high speed streets), land-use mix, crash rate and crime rate.

First, students from neighborhood schools (Mean = 41%) are more likely to walk to or from school than non-neighborhood school students (Mean = 25%) (Figure 13). Second, regarding a school's centrality in the neighborhood in terms of school-community relations, neighborhood schools are likely to have higher centrality than non-neighborhood schools in both objective and subjective measures by: 0.011 in closeness centrality, 0.004 in betweeness centrality, 0.58 miles in geographical centrality, and 11.0% in perceived centrality. But, the Kruskal-Wallis test warns that the difference in "perceived centrality" is not significant ($p = 0.117$). Third, among two measures of social capital, a neighborhood school's parents are 26.3% less likely to volunteer at school affairs than non-neighborhood school parents but no significant difference in social cohesion ("feel connected") has been shown in this study. Fourth, neighborhood

schools are more likely to have both Hispanic and low-income students than non-neighborhood schools while there is no significant difference in their enrollment size.

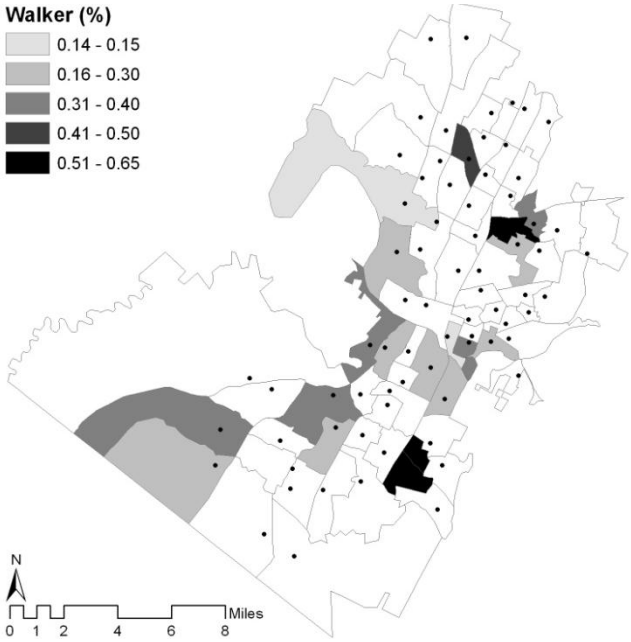

Figure 13

Percentage of Students Walking to/from School

Last, as for environmental settings of the 19 schools, communities in which neighborhood-schools are located have: a 5.563 higher population density (per acre), a 0.092 higher street intersection density (per acre), a 43.152 higher street density (per acre), a 0.234 higher land use mix, a 1.862 higher crash rate (per mile/year), and a 42.89 higher crime rate (per 100 acres/year), while having a 5.40% lower portion of high-speed streets than communities of non-neighborhood schools. The patterns of mean differences of socioeconomic and environmental factors between study schools (N=19) and AISD schools (N=73) appear consistent overall (Table 15).

Table 15

Mean Differences between Neighborhood and Non-neighborhood Schools

Variable	N	Neighborhood School (n=8)		Non-neighborhood School (n=11)		ANOVA		Kruskal-Wallis Test	
		Mean	SD	Mean	SD	F	Sig.	$\chi 2$	Sig.
Children's Walking to School Behaviors									
Walking-to-school (%)	19	41.1	18.3	25.0	18.7	7.427**	0.014	4.792**	0.029
School's Centrality									
Closeness centrality	19	0.018	0.126	0.007	0.008	5.311**	0.034	6.552**	0.010
Betweenness centrality	19	0.008	0.004	0.005	0.003	4.696**	0.045	4.970**	0.026
Geographical centrality (mile)	19	0.295	0.105	0.879	0.789	4.261*	0.055	4.261**	0.039
Perceived centrality (%)	19	59.8	14.8	48.8	9.6	3.932*	0.064	2.461c	0.117
Social Capital									
Volunteer at school (%)	19	27.7	14.4	54.0	29.1	5.524**	0.031	2.209c	0.137
Feel connected (1:very unlikely-5:very likely)	19	3.645	0.159	3.721	0.325	0.369	0.552	0.170	0.680
Socioeconomic Factors									
Hispanic students (%)	19	77.7	18.5	46.6	31.7	6.126**	0.024	5.734**	0.017
	73	75.3	16.9	53.8	26.6	11.209***	0.001	10.907***	0.001
Economically disadvantaged (%)	19	87.4	16.4	47.9	40.1	6.845**	0.018	4.970**	0.026
	73	88.7	14.6	61.7	34.5	11.381***	0.001	12.039***	0.001
Student enrollment	19	697.8	173.1	632.1	212.6	0.513	0.483	0.552	0.457
	73	568.2	204.1	625.9	217.9	1.052	0.309	0.861	0.354
Environmental Factors									
Population density (per acre)	19	10.675	2.900	5.112	3.717	12.368***	0.003	9.845***	0.002
	73	9.870	2.644	5.662	3.409	24.771***	0.000	21.628***	0.000
Street density (per acre)	19	154.241	35.634	111.089	33.122	7.383**	0.015	4.970**	0.026
	73	165.237	45.772	125.059	45.439	11.308***	0.001	10.342***	0.001
Street intersection density (per acre)	19	0.240	0.111	0.148	0.061	5.323**	0.034	3.927**	0.048
	73	0.266	0.131	0.171	0.094	11.734***	0.001	13.313***	0.000
Land-use mix	19	0.559	0.084	0.325	0.219	8.108**	0.011	5.161**	0.023
	73	0.475	0.215	0.441	0.252	0.283	0.597	0.542	0.462
High-speed street (>30mph)(%)	19	15.6	4.6	21.0	5.5	5.126**	0.037	4.261**	0.039
	73	16.1	5.7	22.3	77.5	11.452***	0.001	9.561***	0.002
Crash rate (per mile/year)	19	6.408	2.904	4.546	4.024	1.235	0.282	3.607*	0.058
	73	5.415	2.481	4.392	2.794	2.064c	0.155	4.267**	0.039
Crime per year (per100 acres)	19	82.390	35.031	39.496	43.795	5.217**	0.035	5.345**	0.021
	73	71.629	29.620	44.733	39.391	7.660***	0.007	10.988***	0.001

* p <0.1, ** p <0.05, and *** p <0.01 (^{C} marginally significant at the 0.1 level); SD is standard deviation.
For comparison with study schools (N=19), all available data from 73 schools is provided.

4.5 DISCUSSION

After defining neighborhood schools by school attendance zone area and student density within a walking distance, Section 4 presented two major findings from the school/community-level data analysis related to the measurement of school-community relations and the comparison between neighborhood and non-neighborhood school-communities.

First, from the correlation analysis among four centrality measurements, the objectively measured centrality values are not correlated with people's perceptions about a school's centrality. However, two spatial centrality values based on accessibility and connectivity of street networks show moderate associations with geographical centrality of school. These spatial centrality indices can be applied for research and as policy aid tools focusing on school siting and attendance boundary delineating.

Second, evidences implied that neighborhood schools are more likely to have a higher school's centrality index than non-neighborhood schools and larger population walking to school. Also the communities where neighborhood schools are located are likely to have more compact and dense urban settings in terms of population, street density, or land use mix and a lower portion of high-speed streets. However, crime rate is lower in a non-neighborhood school's community.

Several limitations need to be noted for this section. First, the sample size is too small to bring up a parametric problem in conducting mean difference tests. Thus, a non-parametric test is employed as a complimentary check; the statistical significant levels from the non-parametric tests are almost consistent with the ANOVAs. Second, defining

neighborhood schools in this study might be arguable because there is no universal definition. But, multiple definitions from other studies or practices are provided to show a common stance in defining neighborhood schools. Third, GIS and other school-level data are collected at different times from 2000 to 2009. This might result in reduced accuracy.

Further studies are needed to examine a school's spatial centrality with a larger sample size, and with different centrality measurements. Different socio-geographical settings should be considered for testing validity, such as urban/suburban/rural, metro/non-metro or large-/mid-/small-sized cities. The centrality of other land use in large communities, such as commercial centers, transit stops, or parks which are significant components in a community design process, can be studied using spatial centrality to build platforms for evidence-based community design.

5. INDIVIDUAL-LEVEL FULL ANALYSIS: SCHOOL-COMMUNITY RELATIONS AND WALKING TO SCHOOL, IS SOCIAL CAPITAL A MEDIATOR?

5.1 INTRODUCTION

This cross-sectional study focuses on better understanding the roles of social capital in relation to children's walking-to-school behavior and school-community relations. Social capital is considered as an important indicator of school-community relations from both social perspectives (Comer, 1980; Kretzmann and McKnight, 1996; Driscoll and Kerchner, 1999) and physical envirnomental perspectives (King et al., 2002; Sallis et al., 2006).

As conceptualized in the theoretical framework and conceptual model in Section 3, this section follows the two phases (Figure 14): Phase I examines the relationship between school-community relations and parental social capital, and Phase II assesses the mediating effects of social capital in the association between school-community relations and children's walking to school behaviors.

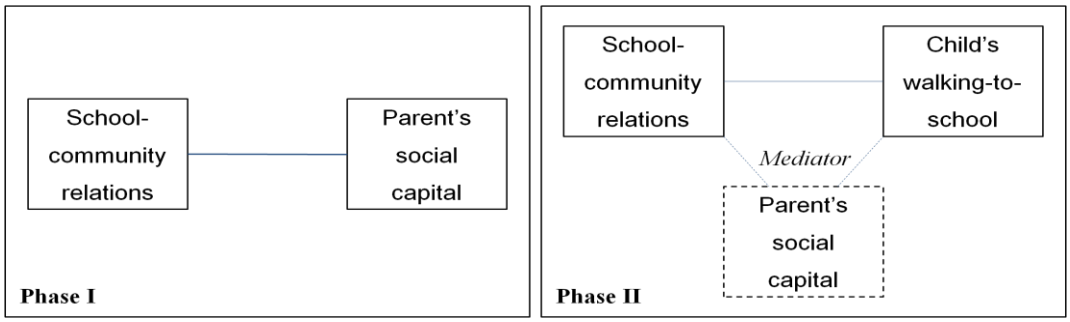

Figure 14

Two Phases of Analysis

5.2 OBJECTIVES

This study tests three primary hypothese of this study, including:

- Hypothesis 1.1 (H 1.1): School-community relations (both subjective and objective measures of centrality) will be associated with children's walking-to-school behaviors.
- Hypothesis 1.2 (H 1.2): School-community relations will be associated with parent's social capital.
- Hypothesis 1.3 (H 1.3): Parental social capital will mediate the relationship between school-community relations and children's walking-to-school behaviors.

5.3 METHODS

5.3.1 Measurement

The data used for this section come from the Safe Routes to School (SRTS) survey including 4,626 parental participants. The SRTS instrument consist of five groups of variables: (a) the school travel factors including travel mode, environmental features and barriers along the route, sidewalk presence and conditions, walking attitudes and behaviors, safety concerns, travel time and perceived distance, (b) physical environment-related factors, including neighborhood perceptions, physical barriers, positive and negative environmental changes and overall walking environmental conditions, (c) personal socio-demographic and socioeconomic factors, including children's gender, grade, race, health condition, parent's education, number of siblings, income-related

variables (e.g., household income, special lunch program and health insurance), car ownership and having a driver's license, and pet ownership.

Specifically, the main study variables include: (d) parental social capital level, measured with the questions "Have you volunteered at your child's school in the past 12 months? (Yes=1/No=0)" and "I feel connected to people in my neighborhood (strongly disagree "1" to strongly agree "5")"; and (e) perceived school's centrality in the community is measured by asking "What do you think the center of your neighborhood? (your child's elementary school=1/others=0)".

5.3.2 Data Analysis

Phase I, the association between school-community relations and parental social capital tests a primary hypothesis (H 1.2). The bivariate correlation analyses are conducted to test out each independent variable with the outcome variable of social-capital, using unadjusted logistic regression. Variables insignificant in the bivariate analyses or having multicollinearity problems and high number of missing values are excluded, except for several theoretically significant variables.

After selecting a set of independent variables, a series of multivariate logistic regressing analyses are performed to build a base model. The final base model consists of 13 variables. Finally, the association between school-community relations and parental social capital is examined after controlling for the base model variables. The statistical software SPSS 17.0 is used for all analyses.

Phase II-1, the association between school-community relations and children's walking-to-school behavior, is to test a primary hypothesis (Hypothesis 1.1). Similar to Phase I, after identifying key factors grounded in the existing studies with multicollinearity and missing values tests, a series of multivariate logistic analyses are performed to build a base model including correlates of walking-to-school behavior. Then, each measure of a school's centrality is added to this base model one at a time to test its relationship with children's walking-to-school behavior, using multivariate logistic regression in SPSS 17.0.

Phase II-2, is social capital a mediator?, tests one of the primary hypothesis (Hypothesis 1.3). The mediating effect of social capital in the association of Phase II-1 is examined by the Sobel test. The Sobel test is a statistical analysis which examines the null hypothesis of no mediation effect (Sobel, 1987; Sobel, 1982; Soper, 2009). Baron and Kenny (1986) also provide the theoretical basis of mediating effects; this study follows the recommended steps for conducting the mediating effect test(Baron and Kenny, 1986).

5.4 RESULTS

5.4.1 The Association between School-Community Relations and Parental Social Capital (Phase I)

5.4.1.1 Descriptive Statistics and Bivariate Analysis

The individual-level data collected by the SRTS survey shows that more than half of parents (55.8%) perceived their child's elementary school is the center of their neighborhood. About the parental social capital indicators, 42.0% of parents volunteered at child's school in the past year and more than half of the parents likely to feel connected to their neighborhood (Mean = 3.72 and SD=1.255) (Table 16).

Table 16

Descriptive Statistics of School-Community Relations and Parental Social Capital

Variable	Definition	Sample Size	Mean	SD	Min	Max
School-Community Relations (school's centrality in community)						
Closeness centrality	The inverse sum of the shortest routes of school's node to every other node in the attendance boundary	4626	0.117	0.011	0.001	0.038
Betweenness centrality	The ratio of shortest routes on which school's node lies in the attendance boundary	4626	0.005	0.004	0.002	0.015
Geographical centrality (mile)	Distance from the school to the geographical centroid of the attendance area	4626	0.616	0.657	0.136	2.438
Perceived centrality (%)	"Which do you think is the center of neighborhood?" (child's elementary school=1, other=0)	4024	55.8	0.495	0	1
Parental Social Capital						
Social cohesion	"I feel connected to people in my neighborhood" (1=strongly disagree; 5=strongly agree)	4380	3.72	1.255	1	5
Volunteerism (%)	"Have you volunteered at your child's school in the past 12 months?" (yes=1, other=0)	4460	42.0	0.493	0	1

SD is standard deviation, Min is minimum and Max is maximum value.

At the school/community-level, parents from the larger school attendance zone are likely to have stronger social capital than the parents in smaller communities (Figure 15).

With two social capital items as outcome variables, bivariate analyses are conducted, including parent's socio-demographic factors, socioeconomic status, environmental perception and social perception about community. All individual survey items are used for socio-demographic factors and socioeconomic status are used for environmental and social perception by averaging the adequately correlated items which are all on a 5-point Likert scale. Each independent variable is tested for its bivariate correlation by the unadjusted logistic regression analyses with the binary outcome variables indicating parental social capital level, social cohesion, and volunteerism. The correlation patterns of two social capital items look similar to each other. A household's health insurance was not significant with social cohesion and peer influences was not significantly correlated with volunteerism (p-value > 0.1). Thus, these non-significant variables are excluded from further analyses (table 17).

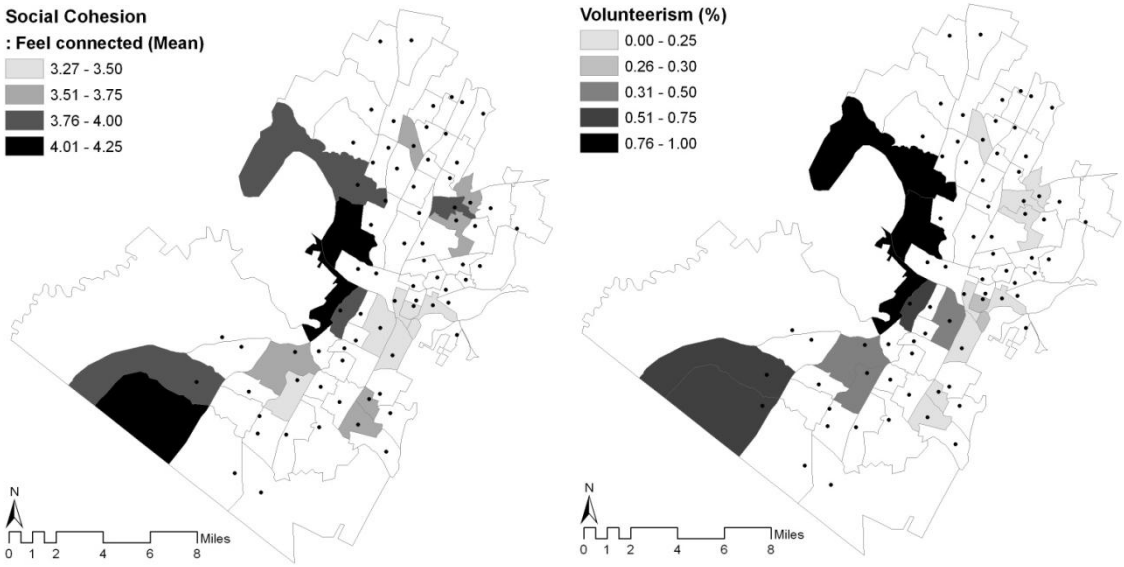

Figure 15

Parental Social Capital in GIS

Table 17

Bivariate Correlates of Parental Social Capital: Unadjusted Logistic Regressions

Class	Predictor	Coding Scheme	Volunteerism (outcome 1)		Social Cohesion (outcome 2)	
			±	OR	±	OR
Socio-demographic Characteristic	Parent's ethnicity	Hispanic:1 (binary)	−	0.166***	−	0.767***
	Parent's immigrant status	Born in U.S:1 (binary)	+	3.702***	−	0.669***
	Length of residence	Years of residence (continuous)	+	1.071***	+	1.035***
	# of siblings	Number of siblings (continuous)	−	0.721***	−	0.877***
	Highest education in household	6th grade or less:1 ~ graduate or professional degree:7	+	2.036***	+	1.112***
Socioeconomic Status	Child's special lunch program	Free/reduced lunch:1 (binary)	−	0.103***	−	0.398***
	Health insurance	Health insurance in household:1 (binary)	+	2.482***	+	1.087
	Car ownership	Number of cars in household (continuous)	+	2.169***	+	1.512***
	Income	Having any pets:1 (binary)	+	1.601***	+	1.250***
	Grocery shopping	How many times per month buying groceries? (continuous)	+	1.195***	+	1.120***
	Pet ownership	Having any pets:1 (binary)	+	3.049***	+	1.463***
Environmental Perception	Overall environment condition of neighborhood (composite)	"It is convenient to walk to school" "It is well maintained and clean" "It is well shaded by trees" "It is quiet" "There are nice things to see" "Streets are well lit" "The school zones are well enforced"	+	1.078**	+	2.024***
Social Perception	Safety concerns (composite)	"My child may get lost" "My child may be taken or hurt by a stranger" "My child may get bullied, teased or harassed" "My child may be attacked by stray dogs" "My child may be hit by a car" "Exhaust fumes may harm my child's health" "No one will be able to see and help my child in case of danger" "My child may get injured by falling"	−	0.934***	−	0.854***
	Peer influence (composite)	"Other kids walk to/from school in my neighborhood" "Other kids and parents walk quite often in their daily routines"	−	0.995	+	1.774***

* p <0.1, ** p <0.05, and *** p <0.01;
OR is odd ratio and ± is direction of association.

5.4.1.2 Correlates of Social Capital

With the selected variables from socio-demographic characteristics, socioeconomic status, environmental perception and social perception, two multivariate logistic regressions are conducted to predict the odds of two binary social capital items, including "social cohesion (feel connected to people in my neighborhood)" and "volunteerism (volunteered at their child's school in the past 12 months)". To estimate the percentage of variance explained by the base model, Nagelkerke's pseudo R^2 is used; the base model for predicting "volunteer" and "social cohesion" are explained by 38.9% and 26.9% of the variance, respectively (Table 18).

Both social capital items show similar direction and pattern of correlates in parent's race and some socioeconomic proxies, including child's special lunch program, income, and pet ownership. Hispanic parents are less likely to feel connected to neighbors and volunteer at their child's schools affairs (OR = 0.820 and 0.834, respectively). Income is positively correlated with the parental social capital, which is further confirmed by negative associations between the special lunch program and social capital. Pet ownership is also a positive correlate.

Differences are also found between two social capital items. Educational level is a positive correlate of volunteerism (OR = 1.452), while being a negative correlate of perceived social cohesion with marginal significance (OR = 0.891). Also, the perceptions of environmental condition and peer concerns show positive associations with perceived social cohesion, but not significant with volunteerism. The different results between social cohesion and volunteerism may be due to their different

constructs. Social cohesion is a perceived connection to the community as an embedded social input, while volunteerism is a behavior as social output. Thus, future analyses should consider these two social capital items differently, and also further examine additional constructs related to social capital.

Table 18

Multivariate Correlates of Parental Social Capital: Adjusted Logistic Regressions

Predictors	Volunteerism (outcome variable 1)					Social Cohesion (outcome variable 2)				
	B	±	OR	95% CI Lower	95% CI Upper	B	±	OR	95% CI Lower	95% CI Upper
Parent's ethnicity	-0.182	−	0.834**	0.700	0.994	-0.199	−	0.820**	0.661	1.016
Born in US	0.133	+	1.142	0.881	1.480	-0.586	−	0.557***	0.399	0.778
Length of residence	0.018	+	1.019*	0.999	1.039	0.009	+	1.009	0.982	1.037
# of siblings	0.008	+	1.008	0.908	1.119	0.031	+	1.031	0.906	1.173
Highest education in household	0.373	+	1.452***	1.286	1.639	-0.116	−	0.891 C	0.766	1.036
Child's special lunch program	-0.667	−	0.513***	0.349	0.754	-0.638	−	0.528**	0.308	0.906
Household health insurance	0.410	+	1.507**	1.015	2.239			-		
Car ownership	-0.003	−	0.997	0.833	1.193	-0.043	−	0.958	0.765	1.199
Income	0.181	+	1.199***	1.096	1.312	0.211	+	1.235***	1.101	1.387
Grocery shopping	0.016	+	1.016	0.985	1.048	0.030	+	1.031 C	0.989	1.075
Pet ownership	0.170	+	1.186 C	0.933	1.507	0.361	+	1.434**	1.046	1.968
Safety concerns (composite)	-0.044	−	0.957 C	0.899	1.020	-0.082	−	0.921**	0.851	0.997
Overall environment condition (composite)	0.010	+	1.010	0.893	1.141	0.459	+	1.582***	1.350	1.855
Peer influence (composite)			-			0.409	+	1.505***	1.339	1.690
N			4626					4626		
Nagelkerke's R^2			0.389					0.269		
Likelihood			1943.314					1272.883		
Chi-square			27.681					17.306		

* p <0.1, ** p <0.05, and *** p <0.01(C marginally significant at the 0.1 level).

OR is odd ratio, ± is direction of association, B is Beta Coefficient and CI is confidence interval.

5.4.1.3 Correlates of Social Capital with School-Community Relations

After controlling for all the variables included in the base model (Table 18), associations between each social capital item and each school-community relation factor are tested (Table 19). The spatial centrality of the school is shown to be negatively correlated with parental volunteerism, while positively correlated with perceived social cohesion (OR = 0.820 for volunteerism and 1.144 for social capital with closeness centrality index; OR = 0.387 and 1.414 with betweenness centrality index).

The perceived school's centrality is a positive correlate of parental volunteerism only (OR = 1.274); meaning that parents who think that their child's school is the center of their neighborhood are more likely to volunteer at the school. However, a school's geographical centrality in a neighborhood is not associated with any social capital items.

Table 19

Correlations between School-Community Relations and Parental Social Capital: Multivariate Logistic Regressions[†]

Predictor	Volunteerism (outcome variable 1)					Social Cohesion (outcome variable 2)				
	B	±	OR	95% CI Lower	95% CI Upper	B	±	OR	95% CI Lower	95% CI Upper
Closeness centrality	-0.198	−	0.820**	0.716	0.939	0.135	+	1.144*	0.975	1.343
Betweenness centrality	-0.950	−	0.387***	0.251	0.596	0.347	+	1.414 C	0.846	2.365
Geographical centrality	0.122	+	1.129	0.933	1.366	0.032	+	1.033	0.806	1.323
Perceived centrality	0.242	+	1.274**	1.002	1.620	0.104	+	1.109	0.821	1.498

* p <0.1, ** p <0.05, and *** p <0.01(C marginally significant at the 0.1 level).
OR is odd ratio, ± is direction of association, B is beta coefficient and CI is confidence interval.
[†] All base model variables shown in Table 18 are controlled.

5.4.2 The Association between School-Community Relations and Children's Walking to School (Phase II-1)

5.4.2.1 Descriptive Statistics and Bivariate Analysis

As mentioned previously, this study use 'walking-to-school' as an important means to promote children's physical activity level. From the SRTS survey data, a majority of students used private cars for school travel modes (53.7% and 44.0%, to and from school respectively), while walking from home to school is 28.2% and from school to home is 30.4% (Table 20).

Table 20

School Travel Modes

Travel Mode	Home-to-School		School-to-Home	
	Frequency	%	Frequency	%
Walk alone (A)	110	2.4	124	2.7
Walk with friends (B)	173	3.7	254	5.5
Walk with a parent/adult (C)	954	20.6	1025	22.2
Walking (A+B+C)	1237	26.7	1403	30.4
School bus	709	15.3	828	17.9
Public bus or light rail	30	0.6	40	0.9
Private car, including carpool	2485	53.7	2036	44.0
Other	71	1.5	69	1.5
Valid sample size	4532	98	4376	94.6
Missing	94	2	250	5.4
Total	4626	100	4626	100

In this study, the outcome variable, 'walking-to-school', captures walkers "from home to school" or "from school to home". Therefore, 34.4% (1,590 out of 4,625 respondents) are classified as walkers and 65.6% as non-walkers (Table 21).

Table 21

Descriptive Statistics of Walking to School

Variable	Measurement	Sample Size	Mean (%)	SD
Children's Walking-to-school	"On a normal day, how does your child travel from home to school?" or "On a normal day, how does your child travel from school to home?" (walk=1, no=0) Walker: 1590 (34.4%) / Non-walker: 3035(65.6%)	4625	34.4	0.475

SD is standard deviation.

For the bivariate analyses on walking-to-school, various groups examined include: (a) child's socio-demographic and family socioeconomic status, (b) perceptual barriers and attitudes about walking-to-school, (c) physical environment-related, and (d) school transportation-related factors, identified from existing evidences and study hypotheses (Table 22).

From the bivariate analysis results by unadjusted logistic regression, 38 of 45 independent variables are used after extracting several variables; first, variables which are statistically insignificant in the bivariate analysis are excluded; second, one variable (household health insurance) is excluded due to potential multicollinearity problems with other income-related variables (Phi Correlation Coefficient = 0.773); third, a variable about a child's BMI is extracted because of a large number of missing values (46.8%); and last, "child's gender", "child's grade", "child's race" and "special lunch program" were selected as theoretically significant variables and forced to remain in the model regardless of their statistical significance. Also, the composite scores are calculated for the perceptual variables captured in a 5-point Likert scale, by averaging the value of significantly correlated variables within the same group.

Table 22

Bivariate Correlates of Walking to School: Unadjusted Logistic Regressions

Predictors	Coding Scheme or Description	N	Mean	Sig.	OR
(a) Child's Socio-demographic and Socioeconomic Status					
Child's gender	Male=1, Female=0	4489	0.49	0.504	0.959
Child's grade	Pre-k=-1; Kindergarten=0, 1st grade=1, etc.	4477	1.98	0.065	0.969*
Child's ethnicity	Hispanic=1, Non-Hispanic=0	4294	0.64	0.000	1.836***
Parent's education	6th grade or less=1 ~ graduate or professional degree:7	4427	3.57	0.000	0.752***
Special lunch program	Free/reduced lunch=1, none=0	4145	0.64	0.000	2.175***
Length of residence	Years of residence (continuous)	4304	5.15	0.000	0.976***
# of siblings	Number of siblings (continuous)	4418	2.57	0.000	1.148***
Health insurance	Health insurance=1, none=0 (household)	4339	0.89	0.016	0.790**
Car ownership	Number of cars in household (continuous)	4321	1.59	0.000	0.693***
Pet ownership	Having any pets=1, no pet=0	4247	0.44	0.000	0.655***
Child's BMI	Body Mass Index (continuous)	2408	19.863	0.001	1.017***
(b) Perceptual Barrier and Attitude					
Safety concerns (strongly disagree=1 ~strongly agree=5)	"My child may get lost"	4354	2.97	0.000	0.763***
	"My child may be taken or hurt by a stranger"	4393	3.74	0.000	0.724***
	"My child may get bullied, teased, or harassed"	4348	3.26	0.000	0.849***
	"My child may be attacked by stray dogs"	4387	3.30	0.000	0.847***
	"My child may be hit by a car"	4408	3.85	0.000	0.747***
	"Exhaust fumes may harm my child's health"	4308	2.95	0.000	0.887***
	"No one will be able to see and help my child in case of danger"	4345	3.21	0.000	0.821***
	"My child may get injured by falling"	4349	2.98	0.000	0.875***
Negative attitude (strongly disagree=1 ~strongly agree=5)	"Walking to school involves too much planning ahead"	4314	2.92	0.000	0.721***
	"It's easier/faster for me to drive my child to/from school"	4398	3.99	0.000	0.565***
	"My child has too much to carry"	4356	2.80	0.000	0.753***
	"My child gets too hot and sweaty"	4371	3.17	0.000	0.892***
Positive peer influence (strongly disagree=1 ~strongly agree=5)	"Other kids walk to/from school in my neighborhood"	4385	3.63	0.000	1.957***
	"Other kids and parents walk quite often in their daily routines"	4396	3.78	0.000	1.558***

* p <0.1, ** p <0.05, and *** p <0.01(C marginally significant at the 0.1 level);
OR is odd ratio and Sig. is significant level (p-value).

Table 22 (Continued)

Predictors	Coding Scheme or Description	N	Mean	Sig.	OR
(c) Physical Environment-related					
Environmental barrier (presence=1, absence=0)	Highway or freeway	4370	0.19	0.000	0.473***
	Road with busy traffic	4371	0.52	0.000	0.292***
	Intersection without street signals or stop signs	4371	0.22	0.436	0.941
	Intersection without a painted crosswalk	4371	0.23	0.000	0.520***
	Railway/Light rail	4370	0.04	0.050	0.699**
Presence of sidewalk	No sidewalk=0, Yes, on very few streets=1 ~ Yes, on all streets=4	4397	2.88	0.000	1.351***
Sidewalk condition (strongly disagree=1 ~strongly agree=5)	"Sidewalks are well maintained and clean"	3977	3.84	0.978	1.001
	"Sidewalks are wide enough for two persons to walking together"	3981	3.35	0.025	1.062**
	"Sidewalks are separated from traffic by grass or trees"	3933	3.22	0.000	1.128***
	"Sidewalks are free of obstructions"	3948	3.51	0.733	1.008
Neighborhood's environmental quality (strongly disagree=1 ~strongly agree=5)	"It is convenient to walk to school"	4468	3.39	0.000	1.766***
	"It is well maintained and clean"	4408	3.76	0.000	1.238***
	"It is well shaded by trees"	4402	3.22	0.000	1.181***
	"It is quiet"	4413	3.08	0.000	1.486***
	"There are nice things to see"	4377	3.35	0.022	1.060**
	"Streets are well lit"	4358	3.36	0.000	1.125***
	"The school zones are well enforced"	4390	3.54	0.015	1.059**
(d) School Transportation					
Neighborhood school	Neighborhood school=1, non-neighborhood schools=0	4626	47.84	0.000	2.755***
Distance	Home-to-school distance (mile) generated by GIS (continuous)	3748	1.29	0.000	0.268***
Perceptual distance:	"How long does it take to get to school?" (minute)	4254	10.60	0.165	1.005
School bus service	"Does the school provide bus service for your child?"(yes:1, no=0)	4418	0.33	0.000	0.223***
Availability of adult walking with child	"Are any of those adults available to walk your child to/from school?" (yes:1, no=0)	3964	0.65	0.000	5.473***

* p <0.1, ** p <0.05, and *** p <0.01([C] marginally significant at the 0.1 level);
OR is odd ratio and Sig. is significant level (p-value).

5.4.2.2 Correlates of Walking to School

For building the base model for multivariate logistic regression analyses to predict children's walking-to-school behavior, four groups of variables are considered in a sequential order. The sequential models are tested by Nagelkerke's pseudo R^2. As shown in Table 23, the model with (a) a child's socio-demographic and socioeconomic status variables only explain 6.3% of the total variance of walking-to-school. However, (b) parent's perceptions and attitudes about safety, walking and peer influence capture 26.1% of the variance. Also, (c) physical environment related-factors and (d) school transportation related-factors explain 2.7% and 12.8% of the variance of the total variance, respectively. Thus, the final base model is estimated to capture 47.9% (p=0.021) of the total variance (Table 23).

In this model, a parent's highest education and car ownership, proxies of income, are negatively associated with children's walking-to-school. All three barriers and attitude variables show expected direction of associations with walking to school. But, the physical environment-related variables are not significantly related with children's walking-to-school except for the composite variables on sidewalk conditions.

Students attending neighborhood schools are more likely to be walkers (OR=1.864). Both actual distance (GIS) and perceived distance (close enough=1) show negative relationships with children's walking behavior (OR=0.726 and 2.875 respectively). School bus service has a negative relationship (OR= 0.528) while the availability of adults who walk with the child has a positive association with children's walking-to-school (OR=3.462).

Table 23

Multivariate Correlates of Walking to School: Adjusted Logistic Regressions

Predictors	B	±	OR	95% CI	
				Lower	Upper
(a) Child's Socio-demographic and Socioeconomic Status					
Child's gender	-0.144	–	0.866	0.679	1.105
Child's grade	-0.013	–	0.988	0.923	1.056
Child's ethnicity	0.073	+	1.076	0.750	1.544
Parent's education	-0.224	–	0.799***	0.706	0.904
Special lunch program	-0.189	–	0.828	0.535	1.283
Length of residence	-0.003	–	0.997	0.974	1.021
# of siblings	0.050	+	1.051	0.938	1.177
Car ownership	-0.541	–	0.582***	0.483	0.702
Pet ownership	-0.134	–	0.875	0.668	1.145
(b) Perceptual Barrier and Attitude					
Safety concerns (composite)	-0.072	–	0.930*	0.860	1.006
Negative attitude (composite)	-0.556	–	0.573***	0.495	0.664
Positive peer influence (composite)	0.360	+	1.433***	1.259	1.630
(c) Physical Environment-related					
Environmental barriers (composite)	-0.583	–	0.558	0.265	1.178
Presence of sidewalk	0.102	+	1.108	0.974	1.259
Sidewalk conditions (composite)	-0.239	–	0.787***	0.676	0.917
Neighborhood's environmental quality (composite)	0.164	+	1.179	0.976	1.424
(d) School Transportation					
Neighborhood school	0.623	+	1.864***	1.392	2.498
Distance	-0.321	–	0.726***	0.614	0.858
Perceptual distance	1.056	+	2.875***	2.060	4.012
School bus service	-0.639	–	0.528***	0.383	0.728
Availability of adult walking with child	1.242	+	3.462***	2.569	4.666
N	4626				
Nagelkerke's R^2	0.479				
Likelihood	1639.536				
Chi-square	18.089				

* p <0.1, ** p <0.05, and *** p <0.01(C marginally significant at the 0.1 level).

OR is odd ratio, ± is direction of association and CI is confidence interval and CI is confidence interval.

5.4.2.3 Correlates of Walking to School with School-Community Relations

To explore the association between school-community relations and children's walking behavior, correlations are examined after controlling for the key confounding factors built into the base model (Table 24). Multivariate logistic analyses are used to examine if school-community relation variables are significant correlates of children's walking-to-school (Table 24).

The results show that objectively measured school centrality variables including closeness centrality, betweenness centrality and geographical centrality are not associated with children's walking. However, perceived school's centrality shows a positive association with children's walking (OR=1.391). The spatial network and geographical location of a school are less likely to influence children's walking behavior than people's perceived identity of school as a neighborhood center.

Table 24

Correlations between School-Community Relations and Walking to School: Multivariate Logistic Regressions[†]

School-Community Relations (predictor)	B	±	OR	95% CI	
				Lower	Upper
Physical School-Community Relation					
Closeness centrality	0.015	+	1.015	0.873	1.179
Betweenness centrality	-0.011	−	0.989	0.615	1.591
Geographical centrality	0.054	+	1.055	0.825	1.349
Perceived School-Community Relation					
Perceived centrality	0.330	+	1.391**	1.055	1.834

* p <0.1, ** p <0.05, and *** p <0.01.

OR is odd ratio, ± is direction of association, B is beta coefficient and CI is confidence interval.

[†] All base model variables shown in Table 23 are controlled.

5.4.3 Is Social Capital a Mediator? (Phase II-2)

This study examines the mediating effect of social capital in the association of school-community relations and walking-to-school (Hypothesis 1.3).

First, multivariate logistic regression results show that both "volunteerism" and "social cohesion" are likely to have positive associations with children's walking-to-school (Table 25).

Table 25

Correlations between Social Capital and Walking to School: Multivariate Logistic Regressions[†]

Predictor	B	S.E.	±	OR	95% CI	
					Lower	Upper
Volunteerism	0.268	0.153	+	1.307*	0.968	1.766
Social Cohesion	0.148	0.058	+	1.159**	1.035	1.299

* p <0.1, ** p <0.05, and *** p <0.01.

OR is odd ratio, ± is direction of association, B is beta coefficient, SE.is standard error and CI is confidence interval.

[†] All base model variables shown in Table 23 are controlled.

Second, after controlling for each social capital variable, "perceived school's centrality" is tested by another sequential multivariate logistic regression; other variables of school-community relations are not considered because of their statistical insignificance (Table 26).

From the results, both social capital variables show positive roles in the association between "perceived school's centrality" and children's walking-to-school. With a comparison between before and after considering social capital effects, the beta coefficient of the "perceived school's centrality" is increased by 0.025 and 0.007 with "volunteerism" and "social cohesion", respectively.

Table 26

The Mediating Effect of Social Capital Variables: Multivariate Logistic Regressions

Outcome: **Walking-to-School**	Volunteerism (mediator 1)					Social Cohesion (mediator 2)				
	B	S.E.	OR	95% CI		B	S.E.	OR	95% CI	
				Lower	Upper				Lower	Upper
Perceived centrality	0.355	0.142	1.426**	1.078	1.886	0.337	0.143	1.400**	1.060	1.850
ΔB	0.025(+)					0.007(+)				

* p <0.1, ** p <0.05, and *** p <0.01(^{C} marginally significant at the 0.1 level).
OR is odd ratio, ± is direction of association, B is beta coefficient and CI is confidence interval.

Third, the mediator effects of social capital are examined using the Sobel test, which determines the significance of the indirect effect of the mediator by testing the hypothesis of no difference between the total effect and the direct effect (Preacher and Hayes, 2008; Sobel, 1982; Sobel, 1987; Soper, 2009) (Figure 16).

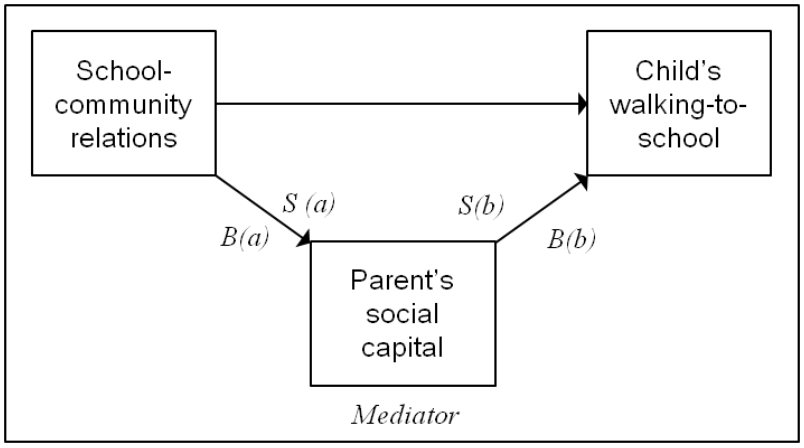

Figure 16

The Sobel Test Concept

When standard errors of B(a) and B(b) are represented, respectively, by S(a) and S(b), the standard error of the indirect effect S(ab) is given as (Preacher and Hayes, 2004; Sobel, 1982):

$$S(ab) = \sqrt{B(b)^2\ S(a)^2 + B(a)^2 S(b)^2 + S(a)^2 S(b)^2}$$

From the results, neither social capital variables attribute significant mediating effects; the null hypothesis of no mediation cannot be rejected, assuming the significance is set at 0.05 (Table 27). The Sobel statistics on "volunteerism" shows some evidence of mediating effect with the p-value of 0.192. However, the results lead to the conclusion that the evidence is insufficient to confirm the mediating effect of social capital.

Table 27

The Sobel Tests Summary

Mediator	*B (a)*	*S (a)*	*B (b)*	*S (b)*	Sobel Statistics	Sig.
Volunteerism	0.241	0.123	0.268	0.153	1.306	0.192
Social Cohesion			0.148	0.058	0.657	0.511

* p <0.1, ** p <0.05, and *** p <0.01 (^{C} marginally significant at the 0.1 level).
B is beta coefficient, *S* is standard error and Sig. is significant level (*p*-value).

5.5 DISCUSSION

Section 5 provides the main analysis of this study using full data analysis. It follows the two phases of analysis desirable by assessing the dynamic association between school-community relations, children's walking to school behaviors and parental social capital.

In the first phase, the results show that there are different directions of associations between objectively measured spatial centrality-volunteerism (negative) and perceived centrality-volunteerism (positive). Considering that volunteerism is significantly associated with parent's education level (+), income (+), and the special lunch program (-), the spatial centrality index might be related with low/high income neighborhoods as well as urban street networks. But, further validity assessments of spatial centrality measurements using larger and typical samples will be needed for future studies.

The result of the second phase identified that "perceived school's centrality" and social capital are significant positive correlates of children's walking-to-school. This result implies that efforts to promote children's walking-to-school should consider strategies to increase the identity of a school in a community and to stimulate community member's participation and social cohesion. However, this study shows that the social capital does not play a mediating role in the association between perceived school-community relation and children's walking behaviors.

6. INDIVIDUAL-LEVEL SUB-GROUP ANALYSIS: THE ROLES OF SOCIAL CAPITAL AND SCHOOL FACILITY JOINT-USE ON CHILDREN'S WALKING TO SCHOOL BEHAVIORS

6.1 INTRODUCTION

Based on the preliminary results on the role of social capital on children's walking-to-school, the sub-group study is conducted to explore more in-depth knowledge of social capital as a correlate of walking-to-school. Specifically, this study utilizes the Parental Social Capital Survey instrument, which is based on the foundation of the popular Putnam's measurement. The factorial structure of the social capital measurement underlying the conceptual complexity needs to be re-examined using appropriate factor analyses in this study.

This sub-group data analyses with more theory-based and detailed variables of social capital is supported by the analytical framework of the previous studies of full data analysis due to its smaller sample size.

6.2 OBJECTIVES

This cross-sectional study mainly focuses on examining the association of parental social capital level and children's walking to school as a proxy of their physical activity level (Hypothesis 1.2). In addition, this study also examines an exploratory hypothesis about the role of recreational use of school facilities on children's walking-to-school (Hypothesis 3.1):

- Hypothesis 1.2 (H 1.2): School-community relations will be associated with parent's social capital.
- Hypothesis 3.1 (H 3.1): Recreational use of school facilities will be positively related to children's walking-to-school behaviors.

6.3. METHODS

6.3.1 Measurement

The Parental Social Capital Survey instrument, which is conducted as a follow-up survey to the SRTS, focused on measuring the level of social capital and recreational use of school facilities among parents. Grounded in the Putnam's social capital measure and other studies on social capital, 11 questions are included in the instrument.

First, Putnam's measures selected for this study are questions scored with a 5-point Likert scales including, "Do you feel that most people in your neighborhood can be trusted?", "Do you feel that most people in your neighborhood are honest?" and "Do you often visit your neighbors?", and yes/no questions including "In the past 12 months, have you voted in an election?", "In the past 12 months, have you served with any community organization? (How many times did you serve?)", "In the past 12 months, have you attended a meeting of a school board? (How many times did attend?)", and "In the past 12 months, have you volunteered at your child's school affairs? (How many times did volunteer?)".

And a few complementary questions based on other literature about social capital are added. Questions scored on a 5-point Likert scale included "Do you feel close to

other people in your neighborhood?", "Do you feel that you belong in your neighborhood?" and "Do you attend church or other religious institutions regularly?" And variables for parent's recreational use of school facilities are measured by asking "Have you used your child's school facilities (e.g., school ground, jogging track, etc.) for your recreational purposes? (yes/no)" and "How often do you use these facilities per month? (times/month)".

Both telephone and email survey methods are conducted May 2011 through July 2011. Among the 1,623 target population, only 237 participated in this study (response rate is 14.60%). There were 161 telephone survey respondents and 76 email survey respondents. Since such a low response rate may cause a bias problem in explaining the parametric circumstance of the social capital level in the community, this study holds complementary views by utilizing and comparing with the full-data study in Section 5.

For the telephone survey, to reduce bias and avoidance, a bilingual interviewer who used to work in conducting the SRTS survey is hired. For the e-mail survey, Survey Monkey™ is utilized for those who provided only email addresses or are not reached by the telephone interviewer.

6.3.2 Data Analysis

Factor analyses are performed on the social capital variables from Putnam's measures to test the concurrent validity with the existing measurement scheme by a series of confirmatory factor analysis (CFA) and to explore an alternate factor loading

for a better explanation of the social capital concept by explanatory factor analysis (EFA).

In CFAs and EFAs, the model fit tests are performed using the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) (Brown, 2006). The categorical factor analyses supported by MPLUS 5.2 are used in this study.

The association between social capital and children's walking-to-school for the sub-group study is performed based on the alternate factor loading. Due to the potential bias of the subgroup sample, the multivariate analyses for predicting the correlates of walking utilized the base model from the full data analysis. Considering the smaller sample size of the subgroup compared to the full data, additional missing value analyses are conducted and variables having an extreme missing value are removed from the original base model.

Then, the association between the parental social capital variables and children's walking-to-school is examined through a series of multivariate logistic regression after controlling for the base model factors. For the analyses, the statistical software SPSS 17.0 is used.

The role of recreational use of school facilities on children's walking-to-school is tested for Hypothesis 3.1, based on the same analysis scheme as the previous analyses. This study used the multivariate logistic regression using the same base model predicting correlates of walking-to-school of the sub-group.

6.4 RESULTS

6.4.1 Factor Analyses

As shown in Section 3, social capital is commonly known as not a single entity, but a variety of entities having multiple characteristics based on the disciplines of sociology, political science, and economics. Although the concept of social capital varies, Robert Putnam is one of those who popularized not only the concept but also its measurement. Similar to what subsequent researchers have identified (Hays & Kogl, 2007; Donati & Prandini, 2007; Carpiano, 2006; Petersen, 2002; Putnam, 2000; Narayan and Cassidy,2001; Onyx and Bullen, 2000; Sudarsky,1999; Bourdieu, 1985), Putnam's measurement constructs the common discourses of social capital into the 5 themes; (a) community/organizational life, (b) engagement in public affairs, (c) community volunteerism, (d) informal sociability and (e) social trust; and 14 items at the both the individual and community level[16].

[16] The original correlation results are (Putnam, 2000):

1. Community/Organizational Life
   - Percent of individuals who served on a committee of a local organization in the last year (0.88)
   - Percent of individuals who served as an officer of a club or organization in the last year (0.83)
   - Civic and social organizations per 1,000 population (0.78)
   - Mean number of club meetings attended in the last year (0.78)
   - Mean number of group memberships (0.74)
2. Engagement in Public Affairs
   - Turnout in presidential elections (0.84)
   - Percent of individuals who attended a public meeting on local or school affairs in the last year (0.77)
3. Community Volunteerism
   - Number of non-profit organizations per 1,000 population (0.82)
   - Mean number of times worked on a community project in the last year (0.65)
   - Mean number of times did volunteer work in the last year (0.66)
4. Informal Sociability
   - Percent of individuals who agree: "I spend a lot of time visiting friends" (0.73)
   - Mean number of times entertained at home last year (0.67)
5. Social Trust
   - Percent of individuals who agree: "Most people can be trusted" (0.92)
   - Percent of individuals who agree: "Most people are honest" (0.84).

The parental social capital survey for this study employs 7 individual-level items based on 5 themes of Putnam's social capital measures[17]. The 7 social capital items and descriptive statistics for each item are summarized in Table 28 below:

Table 28

Descriptive Statistics of Social Capital Items

Putnam's Themes	Items	N	Mean	SD
Social Trust	"Do you feel that most people in your neighborhood can be trusted?" (1=very unlikely; 5=very likely)	237	3.64	1.165
	"Do you feel that most people in your neighborhood are honest?" (1=very unlikely; 5=very likely)	237	3.55	1.055
Informal Sociability	"Do you often visit your neighbors?" (1=very unlikely; 5=very likely)	234	3.14	1.424
Engagement in Public Affairs	"In the past 12 months, have you voted in an election?" (1=yes:1; 0=no)	236	36.4(%)	
Community/ Organizational Life	"In the past 12 months, have you served on any community organization?" (1=yes:1; 0=no)	236	42.8(%)	
Community Volunteerism	"In the past 12 months, have you attended a meeting of a school board?" (1=yes:1; 0=no)	235	56.4(%)	
	"In the past 12 months, have you volunteered for your child's school affair?" (1=yes:1; 0=no)	235	68.5(%)	

6.4.1.1 Confirmatory Factor Analysis (CFA)

As the factor structure is identified within a latent factor, social capital, by the existing theoretical underpinnings such as Putnam's, a confirmatory factor analysis (CFA) is performed with a sub-group population (N=237). The statistical software MPLUS 5.2 is used because it supports categorical variables including ordinal and binary variables. And this study employs the weighted least squares (WLS) approach to test the model fit.

[17] The 7 items are selected out of 14 items; items which are community-leveled or irrelevant to the study purpose are excluded. The wording and scales are adjusted a little based on pre-test.

The primary purpose of the CFA in this study is to test the concurrent validity which assesses a measure of how well a particular test correlates with a previously validated measure (Trochim, 2006). According to the CFA results, however, 7 items do not seem to be well loaded on a factor structure of social capital. First, as shown in the correlation matrix (Table 29), items about social perceptions (1 and 2) look tied to each other while other items are less likely to be correlated with them (4, 5 and 7). Also, an item asking about school board meetings is negatively correlated with other items (6); this might be due to the fact that school board meetings tend to be limited to board members and work differently from the other forms of civic participation. This item is eliminated as it may fail to load with the other items.

Table 29

CFA Correlation Matrix for Social Capital Items

	1	2	3	4	5	6	7
1. "Do you feel that most people in your neighborhood can be trusted?"	1.000						
2. "Do you feel that most people in your neighborhood are honest?"	0.803	1.000					
3. "Do you often visit your neighbors?"	0.447	0.451	1.000				
4. "In the past 12 months, have you voted in an election?"	0.383	0.433	0.391	1.000			
5. "In the past 12 months, have you served on any community organization?"	0.236	0.297	0.237	0.682	1.000		
6. "In the past 12 months, have you attended a meeting of a school board?"	-0.210	-0.227	-0.097	-0.279	-0.128	1.000	
7. "In the past 12 months, have you volunteered for your child's school affair?"	0.290	0.263	0.377	0.625	0.458	-0.052	1.000

Second, results from a series of model fit tests using the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) also shows that a factor structure does not work well. When the CFI, with values ranging from 0 to 1, produces values closer to 1.0, and the RMSEA values are equal to or under 0.06, it implies a better model fit. If the RMSEA exceeds 0.08, it implies a poor model (Brown, 2006). However, a factor structure is likely to hold a poor model fit; the RMSEA indicates 0.207, which is over 0.08 (Table 30).

Table 30

CFA Model Fit Tests for Social Capital Items

Model	x^2	Comparative Fit Index (CFI)	Root Mean Square Error of Approximation (RMSEA)
1-factor (based on Putnam's)	100.145 (*df*=9)	0.913	0.207

df: degree of freedom

Accordingly, this study explores an alternative way to load the items within the theoretical foundations of social capital. Based on the correlation results of the CFA (Table 29), some potential patterns of latent variables have been shown. Thus, an alternative factorial structure is tested through Exploratory Factor Analysis (EFA).

6.4.1.2 Exploratory Factor Analysis (EFA)

The statistical software MPLUS 5.2 is used to run EFAs with one through a four-factor structure. The item about "attending a meeting of a school board" is removed

before conducting the EFA because it did not well load on the factor in the CFA. Afterwards, CFAs are run to determine the fit of the model using weighted least squares (WLS). Thus, the final solution has a better model fit, with a two-factor structure of social capital with the remaining 6 items; 3 items from the social trust and informal sociability themes; the other 3 items from the community/organizational life and community volunteerism themes (Table 31). The CFI is 0.984 and RMSEA is 0.066, which indicate this structure can be accepted as a better model.

With the theoretical underpinnings, the pattern of the final factor loadings imply that this social capital construct is related to the "output-oriented (input/output)" and "integrated" types as mentioned in the previous section (Inglehart, 1977; Schiff, 1992; Thomas, 1996; Putnam, 1993) (Table 2). Also, this pattern looks consistent with Coleman's (1990) dichotomous characterization of social capital as social structure and certain actions of individuals who are within the social structure.

Even though social capital is a collective variety of different entities, it has two characteristics; some aspects of social structure and certain actions of individuals facilitated by the social structure.

Likewise, from the EFA result, it can be assumed that social capital is structured by two factors, (a) "social input" of the existing social structure, including "social trust" and "informal sociability", and (b) "social outcome" as an social member's behavioral factor, including "vote", "volunteerism" and "participation" (Table 31).

Table 31

Factor Loading for the Alternative Social Capital Scale

Items	Factor 1: **Social Input**	Factor 2: **Social Outcome**
1. "Do you feel that most people in your neighborhood can be trusted?"	**0.908**	0.404
2. "Do you feel that most people in your neighborhood are honest?"	**0.885**	0.443
3. "Do you often visit your neighbors?" [18]	**0.507**	0.433
4. "In the past 12 months, have you voted in an election?"	0.465	**0.945**
5. "In the past 12 months, have you served on any community organization?"	0.299	**0.703**
6. "In the past 12 months, have you volunteered for your child's school affair?"	0.345	**0.674**

6.4.2 The Association between Social Capital and Walking to School in Subgroup

This sub-group study focusing on the detailed social capital measures examines the association between social capital and children's walking-to-school using the same analytical structure as the full data analysis in the Section 5.

The base model for predicting children's walking behavior is employed (Table 23). However, considering the difference of valid sample size between full data and the subgroup (4,626 and 237, respectively), the extreme cases of missing value patterns are additionally conducted on all the variables from the base model using Missing Value

[18] The informal sociability item, measured by asking "do you often visit your neighbors?" has moderate correlation of 0.507 and 0.433 with the factor 1 and 2, respectively. In the real world, informal visiting neighbor often tends to be social input as well as outcome. In this study, this item is included in the factor 1 as having higher value of correlation.

Analysis (MVA) supported by SPSS 17.0. From the MVA results, two variables having more than 15% of missing value, are excluded from the original base model for predicting walking-to-school, including “home-to-school distance” and “sidewalk condition”.

The correlation pattern is similar to the original base model with full data analysis in car ownership, negative attitude, perceptual distance, and bus service. With no unique correlates, some variables became insignificant in this model, such as parent’s education, safety concerns, positive peer influence, neighborhood school, and walking with adults. It might be due to a decrease of statistical power with a smaller sample size. But, overall, in spite of the smaller sample size, this final model looks consistent with the full data model and is a better model-fit for predicting children’s walking-to-school behavior with a capture of 57.0% of the total variance (Table 32).

Table 32

Sub-Group Correlates of Walking to School: Multivariate Logistic Regressions

Predictors	B	±	OR	95% CI Lower	high Upper
(a) Child's Socio-demographic and Socioeconomic Status					
Child's gender	-0.152	−	0.859	0.314	2.353
Child's grade	-0.136	−	0.873	0.648	1.176
Child's ethnicity	0.582	+	1.789	0.361	8.859
Parent's education	0.094	−	1.099	0.704	1.714
Special lunch program	-0.053	−	0.948	0.200	4.492
Length of residence	0.015	+	1.015	0.917	1.123
# of siblings	0.507	+	1.661	0.961	2.870
Car ownership	-0.706	−	0.494[c]	0.209	1.167
Pet ownership	-1.343	−	0.261	0.075	0.912
(b) Perceptual Barrier and Attitude					
Safety concerns (composite)	-0.037	−	0.963	0.690	1.344
Negative attitude (composite)	-1.104	−	0.331***	0.178	0.619
Positive peer influence (composite)	-0.008	−	0.992	0.602	1.635
(c) Physical Environment-related					
Environmental barriers (composite)	-1.553	−	0.212	0.010	4.407
Presence of sidewalk	0.100	+	1.106	0.710	1.721
Neighborhood's environmental quality (composite)	-0.316	−	0.729	0.411	1.293
(d) School Transportation					
Neighborhood school	0.657	+	1.929	0.563	6.609
Perceptual distance	1.879	+	6.550***	1.703	25.195
School bus service	-1.671	−	0.188**	0.050	0.704
Availability of adult walking with child	1.103	+	3.014	0.716	12.686
N	237				
Nagelkerke's R^2	0.565				
Likelihood	113.652				
Chi-square	4.570				

* p <0.1, ** p <0.05, and *** p <0.01 ([C] marginally significant at the 0.1 level).

OR is odd ratio, ± is direction of association and CI is confidence interval and CI is confidence interval.

After controlling for the socio-demographic and SES, perceptual barrier and attitudes, physical environment-related and school transportation-related factors, the results of the bivaraite correlates between six social capital variables and children's walking-to-school are provided in Table 33.

Among six variables from two factors, there are only two correlates from one factor (social outcome: factor 2). "Volunteered for child's school affair" shows the highest positive correlation and "serving on the community organization" also had positive correlation while "voting" showed no relationship with a child's walking-to-school behavior. However, all the variables indicating social input factors showed a non-significant association with walking, including "social trust" and "informal sociality (informal visit)".

Similar to the full data analysis, children's walking is more likely to be associated with social outcomes such as volunteerism or serving community organizations than perceived sociality like social cohesion or trust.

Table 33

Correlations between Social Capital and Walking to School in the Sub-group: Multivariate Logistic Regressions†

Predictor	B	S.E	OR	95% CI	
				Lower	Upper
Social Input (Factor 1)					
1. "Do you feel that most people in your neighborhood can be trusted?"	-0.371	0.319	0.690	0.369	1.289
2. "Do you feel that most people in your neighborhood are honest?"	-0.228	0.336	0.868	0.317	2.375
3. "Do you often visit your neighbors?"	0.167	0.242	1.182	0.736	1.899
Social Outcome (Factor 2)					
4. "In the past 12 months, have you voted in an election?"	-0.602	0.803	0.548	0.114	2.642
5. "In the past 12 months, have you served on any community organization?"	1.063	0.603	2.895*	0.888	9.442
6. "In the past 12 months, have you volunteered for your child's school affair?"	1.948	0.882	7.017**	1.245	39.568

* p <0.1, ** p <0.05, and *** p <0.01.

OR is odd ratio, ± is direction of association, B is beta coefficient and CI is confidence interval.

† All base model variables shown in Table 23 are controlled.

6.4.3 The Role of Recreational Use of School Facilities on Walking to School

This additional study is to test an exploratory hypothesis (Hypothesis 3.1). The purpose is to explore if a school joint-use program[19] can promote a community's cohesiveness by providing school facilities for educational or recreational purposes in terms of a school-community partnership. Thus, this study focuses on community use of school facilities for recreational purposes which might be related to promoting children's walking-to-school behaviors.

The measurement is used a question asking "Have you used your child's school facility for your recreational purposes?" and "Could you tell me how often do you use per month (times/month)?" in the sub-group survey. From the descriptive statistics, 63% of survey respondents have used the school facilities for recreational purposes and their usage averaged 3.47 times per month. Also, the bivariate analyses show both variables have positive relations with children's walking-to-school. The descriptive statistics and bivariate analysis are presented in Table 34.

[19] The statewide joint use task force (JUST) was established in May 2008. From their definition, joint use is "a way to increase opportunities for children and adults to be more physically active. It refers to two or more entities — usually a school and a city or private organization — sharing indoor and outdoor spaces like gymnasiums, athletic fields and playgrounds. The concept is simple: share resources to keep costs down and communities healthy (http://www.jointuse.org/)."

Table 34

Descriptive Statistics and Bivariate Correlates between Joint-use and Walking to School: Unadjusted Logistic Regressions

	N	Mean	Sig.	OR
"Have you used your child's school facility for your recreational purposes (1=yes, 0= no)?"	235	63.6(%)	0.011	2.013**
"How often do you use per month (times / month)?"	230	3.47	0.048	1.052**

* p <0.1, ** p <0.05, and *** p <0.01.
OR is odd ratio and Sig. is significant level (p-value).

However, multivariate analyses after controlling for other confounding factors in the base model shows that there are no statistically significant associations between "school facility usage" and walking-to-school (Table 35). However, there is still some evidence that recreational usage of school facilities might have a partial but positive correlate with children's walking-to-school as it is marginally significant at the 0.1 level (OR=2.649, p=0.114).

Table 35
Correlations between Joint-use and Walking to School: Multivariate Logistic Regressions†

Predictor	B	S.E	OR	95% CI	
				Lower	Upper
"Have you used your child's school facility for your recreational purposes?"	0.974	0.616	2.649c	0.792	8.862
"How often do you use per month?"	0.053	0.059	1.054	0.938	1.184

* p <0.1, ** p <0.05, and *** p <0.01.
OR is odd ratio, ± is direction of association, B is beta coefficient and CI is confidence interval.
† All base model variables shown in Table 23 are controlled.

6.5 DISCUSSION

Section 6 explores the detailed social capital as a correlate of children's walking-to-school utilizing the detailed factorial structure of social capital measurement based on the sub-group data. In addition, the role of school facility joint-use on children's walking-to-school is examined as an exploratory analysis.

First, the results from factor analyses suggest a two-factor structure of social capital, which separates "social input" from "social outcome"; the items are not loaded into one factor - social capital as the original measurement assumed. However, the "input-output" structure and two characteristics of social capital are already addressed by reviewed literature and are conceptually similar to this study's alternative factor structure.

Second, based on the alternative factor loadings, the correlates of children's walking-to-school with detailed social capital variables are examined. The results show that only "volunteerism" and "participation" variables from social outcome factors are positive correlates of walking. The findings are also consistent with the results from the full-data study in which "volunteerism" is the only correlate of children's walking-to-school. Therefore, it is assumed that social environment promoting community member's behavioral participations is more important than social perceptions or informal sociality regarding children's walking behaviors in their neighborhood.

Third, however, recreational joint-use of school facilities has no significant relationship with children's walking-to-school; but a marginal impact is possible (at the 0.1 level). This result might discourage the current efforts to expand joint-use programs

but there is unexamined potential limitation about the association between different population groups – parents as facility user and children as walker.

Moreover, limitations from survey administration, timing and conducting email and phone surveys might cause inaccuracy of data and biased results on this sub-group study. Thus, the full-data analysis in the previous parts is used with a complimentary view when carrying out this sub-group analysis.

7. CONCLUSION AND DISCUSSION

> People love this school….It's small, so students can receive personal attention. Children can walk to school. It's safe and pleasant to do so because the neighborhood has sidewalks lined with trees and well-maintained homes. Having served three generations of students, the school embodies an important part of the neighborhood's history
>
> - Beaumont and Pianca, 2002

This dissertation brings attention to the significance of school-community relations and the social capital concept into the emerging issue of children's physical activity regarding school transportation. Studies on children's physical activity often ignore the role of socially structured school-community relations especially on children's walking-to-school, a proxy factor for physical activity. However, it has been witnessed that there has been a growing agreement about the significance of a neighborhood school to promote children's walking-to-school in the cohesive relationship with its community settings.

This study has bridged the knowledge gaps between different but closely related disciplines about school-community relations, social environment in a community context, and children's walking-to-school behavior with an evidence-based approach. The final section provides an overall summary of findings, implications from findings, potential contributions and limitations of this dissertation study.

7.1 CONCLUSION

Section 4 examines the differences between neighborhood schools and non-neighborhood schools in the community-level dimensions of school-community

relations, social capital, socio-economic factors and environmental factors. Among a school's centrality variables indicating school-community relations, three physical centrality indices - closeness centrality, betweenness centrality and geographical centrality are likely to be correlated with each other but not with perceived centrality.

According to non-parametric ANOVA results, neighborhood schools are likely to have more students walking to school and higher school's centrality than non-neighborhood schools, but they are marginally or not significantly different from each other at the social capital level. In a community context, neighborhood schools are likely to be located in communities with higher population densities, higher street and intersection densities, higher mixed land use, lower portions of high-speed streets, and higher crime rates than non-neighborhood schools.

Using the two-phasal theoretical framework built in Section 3, Section 5 focuses on the association of school-community relations and children's walking-to-school and the mediation role of social capital based on the individual-level full data. The first phase examines the association between school-community relations and parental social capital. Among social capital variables, "volunteerism" appeared to have a positive correlate with "perceived centrality" and negative associations with spatial centrality indices, whereas "social cohesion" has a positive correlation with closeness centrality.

Further research is conducted in the second phase, including exploring the association of school-community relations and children's walking-to-school and examining the mediator effect of social capital between them. Thus, it is reported that only "perceived school's centrality" from the indicators of school-community relations

has a positive association, and all variables of social capital, “volunteerism” and “social cohesion”, have a positive correlation with children’s walking-to-school. From predicting the mediating effect of social capital, after controlling “volunteerism” and “social capital”, “perceived centrality” is likely to increase children’s walking level slightly. However, the more vigorous statistical test shows that there is no significant mediating effect of “volunteerism” in the association between “perceived school’s centrality” and ‘children’s walking-to-school’.

Section 6 explores a more detailed dimension of social capital and examines the effect of school facility joint use on children’s walking-to-school with subgroup study data. First, confirmatory and exploratory factor analysis are used for refining the existing social capital measure and suggesting an alternative factorial structure. The result implies that social capital items are likely to work better in a two factor structure – “social input” and “social outcome”. From the analyses, the “social outcome” factors such as “serving on community organization” and “volunteerism” have positive correlation with children’s walking-to-school, while “social input” factors show no correlation. Second, the result also implied that recreational facilities use might increase children’s walking behavior in the marginal level.

The overall findings based on study hypotheses are presented in Table 36.

Table 36

Study Summary

Hypotheses		Method	Section	Result
Primary Hypotheses				
Hypothesis 1.1	School-community relations (school's centrality) will be associated with children's walking-to-school behaviors; in both spatial and perceived relations.	Multivariate Logistic Regression	5	Partly significant: only with 'perceived centrality' (+)
Hypothesis 1.2	School-community relations will be associated with parent's social capital.	Multivariate Logistic Regression	5	Partly significant: all with "volunteerism" (±); and 'closeness centrality' with "social cohesion" (+)
Hypothesis 1.3	Parental social capital will mediate the relationship between school-community relations and children's walking-to-school behaviors.	Sobel test	5	Not significant
Exploratory Hypotheses				
Hypothesis 2.1	The distinctive typology of school-community relations will be identified using spatial centrality indices and socio-environmental factors.	Kruskal-Wallis ANOVA	4	Significant: neighborhood school have more centrality value than non-neighborhood school
Hypothesis 2.2	Objectively measured centrality (spatial centrality index) will be associated with the perceived centrality (survey) of the school in the community.	Pearson's Correlation test	4	Not significant
Hypothesis 3.1	Recreational use of school facilities will be positively related to children's walking-to-school behaviors.	Multivariate Logistic Regression	6	Not significant but marginally exceeded the significant level at 0.1: (+)

(+) positive association and (-) negative association.

7.2 IMPLICATIONS AND CONTRIBUTIONS

7.2.1 Contributions to Research

First of all, as for the measurements, this study introduced the assessment of a school's centrality using both objective measures (spatial centrality index) and a subjective measure (perceived centrality). Studies on the spatial centrality index are growing in physics and planning research fields, mainly focusing on analysis of the network of urban streets (Crucitti et al., 2006; Tomko et al., 2008; Claramunt and Winter, 2007). This study used the spatial centrality index to explore the school-community relations objectively regarding school children's walking-to-school behaviors whereas there are few efforts to connect the spatial centrality concept to human behaviors. Also, it needs to be noted that both objective and subjective measures of a school's centrality appear to be useful methods in quantifying the "school-community relations".

Second, in school-community relations, selecting neighborhood schools quantitatively using school attendance zone (area) and students living within a walkable distance (1/2 miles) might be useful for future studies having a large number of study schools. The criteria reflect common agreements from the diverse normative definitions of neighborhood schools. Also, school-community relations can be considered for high (or middle) schools and for a comparison between public and private schools. High school athletics is especially suggested as a potential determinant of high school-community relations in the United States.

Third, from the multivariate model using the subjective measures from the SRTS survey, perceptual barriers/attitudes (personal attitudes, safety concerns and peer influences) and school transportation related factors (distance, perceptual distance and school bus service) are more likely to be associated with children's walking-to-school than physical environmental factors (environmental quality, barriers and sidewalk presence). Inconsistent with some literature, limited socioeconomic variables (parent's education and car ownership) are significant correlates of walking-to-school while other socio-demographic factors are not significant (gender, grade, race, length of residence, number of siblings and pet ownership). These evidences can be employed to develop other models to explore different types of interventions of walking-to-school. However, from an analysis of the smaller data of subgroup, the correlates became more limited; only perceptual attitudes, perceptual distances and school bus service are significant correlates with walking-to-school. Therefore, future studies should consider that using a large enough sample size could more clearly indentify the interventions for walking-to-school.

Forth, this study contributed to highlight the validity of the existing social capital measures, especially on Putnam's 5 themes. The CFA results show the necessity of an alternative factor structure of social capital. This study suggested a two-factor structure: "social input" and "social output" (from the subgroup study). This structure looks more similar to Coleman's 2 factors ("social structure" and "individual's action") rather than Putnam's 5 themes. In this structure, "social output" factor (such as "volunteerism") is consistently associated with children's walking-to-school behaviors in both small and

large data analysis. Therefore, future research using social capital measures related to human behaviors needs to consider distinctive approaches about the different social capital factor; In this study, while parental social capital variables ("volunteerism" and "social cohesion") are associated with overall parent's socioeconomic status (highest education (+), special lunch program (-) and household income (+)), only social cohesion is significantly related with safety concerns (-), overall environmental conditions (+), and pet ownership (+).

Fifth, the mediating effects of social capital is not significant in the association between school's perceived centrality and children's walking-to-school behaviors. However, considering that a social capital variable (volunteerism) is still reported as a significant correlate of children's walking and that the 4626 individual data is nested into 19 schools, future studies might be able to capture different results using mixed effect model or hierarchical linear model (HLM) to appropriately deal with school-level (school-community relations) and individual-level data (walking-to-school and social capital levels).

Further, future research should consider development of a measurement of children's social cohesion for a better understanding of their behaviors in the community. Despite this study reporting a significant relationship between parental volunteerism and children's walking-to-school behaviors, the assumption of parental influence on children's behaviors still has limitations. In developing the measurement tool, a parent-aided instrument will work better work than self-reports by children.

In addition, the results could not assure that recreational joint-use program of school facilities would play a role on children's walking-to-school; but it still shows some evidence of having a marginal effect. Thus, tailored approaches for more detailed measurement with enough sampled population will be needed in the future.

7.2.2 Policy Implications

The major purpose of this study highlighted major gaps in knowledge of the physical and social relationships between schools and communities and their associations with children's walking to school behaviors. Evidences revealed the significances of school-community relations and social capital not only for a social cohesiveness in the community but also for promoting children's physical activity, especially walking-to-school. Also, the findings can go towards helping decision-making processes in school siting, attendance boundary delineation and school transportation in a manner to promote walking potential for school children:

First, it is an interesting finding that perceptual school's centrality has stronger effects on children's walking than school's spatial centrality measured using street networks or geographical location. It implies that not only school planning and siting but also an abiding partnership with the community will be essential for better school-community relations. Also, it seemed to be worth preserving neighborhood schools having smaller attendance zone boundaries and more student population within walking distance if walking-to-school is seriously considered. Therefore, in delineating or

changing school attendance boundaries, policies should consider preserving the neighborhoods and keeping enough student density within walking distance (1/2 miles).

Second, from the analysis with GIS distance and the SRTS survey, the median distances of home-to-school of all respondents and only-walkers appeared 0.84 miles (Mean = 1.29 miles; SD = 1.419) and 0.48 miles (0.67 miles; SD = 0.843) respectively. Likewise, consistent with other studies, the acceptable walking distance might lie at about ½ miles. Thus, the approximate walking distance for school children needs to be applied to the Safe Routes to School programs in the city of Austin.

Third, based upon the refined social capital concept, social outcome factors such as "volunteerism" or "serving in a community organization" have positive association with children's walking-to-school while social income factors such as "social cohesion" or "informal sociality" have little relationships. Also, "volunteerism" is a significant correlate of school-community relations. Even if the social capital has been conceptualized in an integrated norm, it is important to note that community member's volunteer behaviors are likely to be better related to their children's walking-to-school and social capital than perception-wise social capital dimensions.

Fourth, among other correlates of walking-to-school, perceptual barriers are more likely to have an influence on children's walking than physical environmental changes. Therefore, policy makers should strengthen their educational programs and events for parents and children so as to have enough motivation and emotions for walking-to-school. Also, it might be an important note for policy makers that (a) sidewalk condition, (b) school bus availability, (c) GIS and perceptual distance (home-to-school), (d)

availability of adults who can walk with the child and (e) neighborhood schools are significant correlates of children's walking-to-school behaviors.

Further, this study may contribute to the contemporary community design with evidence-based knowledge focusing on maximizing the cohesiveness of school-community relations and children's walking-to-school as follow (Figure 17):

- Employ the school service sphere concept with community-centered school locations from Perry's Neighborhood Unit Plan; an elementary school is located at the center of the neighborhood with adjacency to parks and community facilities for enhancing the sense of place and accessibility.
- Employ the urban fabrics, mixed-uses and transit-oriented neighborhood concepts from the New Urbanism disciplines; mixed use street and boulevards within/surrounding the neighborhood, transit-oriented and local shopping center located at the local nodes, and small-accessible urban blocks.
- Extend the walking distance of 1/4 mile of Perry's Neighborhood Unit Plan and the New Urbanism concept to 1/2 mile based on the study results
- Within 1/2 miles, the utilitarian land uses (e.g., offices, schools or commercial businesses) are places; within 1/4 miles, the neighborhood stores (e.g., convenient or grocery stores) are placed.
- For defensive neighborhood environments, various traffic calming devices should be installed within the neighborhood.
- Pedestrian-only or pedestrian-friendly paths connect the neighborhood center through local parks and recreational area.

Figure 17

School-centered Community Design Concept

7.3 LIMITATIONS

The findings should be considered in light of several substantial limitations. Several suggestions for future study are presented in response to these limitations:

First, due to the small sample size of school-level data, it may cause a biased parametric problem. Even though a non-parametric test is used, the results from school-level analyses might be limited and inconsistent, especially for the spatial centrality index, which shows a limited significant result. For future research, it is worthwhile to follow-up test the association between school's spatial centrality and walking-to-school and to explore the other correlates of spatial centrality measures with a larger sample size and diversity of communities.

Second, several limitations are brought up with the sub-group study through the Parental Social Capital survey which is a follow-up of the SRTS survey. There might be several problems with a low response rate, timing of the survey administration, and potential known group validity resulting from the recruiting process, even though the results are consistent with the full data analysis. Also, while selecting items collectively and conducting tests in a different type of population, it might be possible to weaken concurrent validity or construct validity for utilizing the existing survey instrument. Therefore, it is recommended to build a tailored research design overcoming such limitations for assessing the in-depth social capital correlates with children's walking to school behaviors.

Third, since the individual-level data is nested in 19 schools, a multi-level modeling might have been appropriate for this study. Also, when predicting the

multivariate correlates of social capital, tailored confounding factors capturing other perceptual and social features should be considered.

Fourth, the problems with a timely inconsistency of data are likely to occur. SRTS survey is conducted in 2010 and the follow-up survey is started a year later. Most GIS data are from 2007 but some are collected at different times. Such different timings of the data set have difficulty in reflecting reliable status-quo information. In future studies, it might be necessary to measure all variables at the same time. And it might be a good idea to coordinate the timing of the survey administration to be consistent with when the city updates the GIS or census data.

Fifth, as the sub-group study used the same base model for the full data analysis, the results can be more comparable but the model fit of the sub-group model might be compromised.

Further, global limitations might be a potential barrier of this study. Ecological fallacy might occur in using a school attendance boundary as a geographical community area, multicollinearity might be a threat in predicting the outcome variables, and external validity might be threatened because the majority of this study relies on self-reported data. In addition, the research design assuming that a parental decision is crucial to children's walking may be subject to bias.

REFERENCES

American Association of School Administrations (AASA). 1950. Public relations for america's schools, twenty-eighth yearbook, American Association of School Administrators. Washington, DC: The Association.

Abdel-Aty, M., Chundi, S. S. & Lee, C. 2007. Geo-spatial and log-linear analysis of pedestrian and bicyclist crashes involving school-aged children. Journal of Safety Research, 38, 571-579.

Addy, C. L., Wilson, D. K., Kirtland, K. A., Ainsworth, B. E., Sharpe, P., et al. 2004. Associations of perceived social and physical environmental supports with physical activity and walking behavior. American Journal of Public Health, 94, 440-443.

Ahlport, K. N., Linnan, L., Vaughn, A., Evenson, K. R. & Ward, D. S. 2008. Barriers to and facilitators of walking and bicycling to school: Formative results from the non-motorized travel study. Health Education & Behavior, 35, 221-244.

Alexander, L. M., Inchley, J., Todd, J., Currie, D., Cooper, A. R., et al. 2005. The broader impact of walking to school among adolescents: Seven day accelerometry based study. British Medical Journal, 331, 1061-1062.

Appleyard, D. 1980. Livable streets: Protected neighborhoods? The Annals of the American Academy of Political and Social Science, 451, 106-117.

Austin Independent School District (AISD). 2007. Community committee on neighborhoods and schools, summary of meeting. Retrieved March, 2011. [Online] from: http://archive.austinisd.org/inside/docs/ccns_summary_20071023.pdf.

Baker, W. 1990. Market networks and corporate behavior. American Journal of Sociology, 96, 589-625.

Barnes, M. 2010. Solving the problem of childhood obesity within a generation. White Paper. Washington, DC: US Executive Office of the President.

Baron, R. & Kenny, D. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51, 1173-1182.

Baron, S., Field, J. & Schuller, T. 2000. Social capital: Critical perspectives, New York, USA: Oxford University Press.

Baum, F. 1999. Social capital: Is it good for your health? Issues for a public health agenda. Journal of Epidemiology and Community Health, 53, 195-196.

Baum, H. S. 2004. Smart growth and school reform: What if we talked about race and took community seriously? Journal of the American Planning Association, 70, 14-26.

Beaumont, C. E. & Pianca, E. G. 2002. Why johnny can't walk to school: Historic neighborhood school in the age of sprawl. Washington, DC: National Trust for Historic Preservation.

Becks, A., Reichling, T. & Wulf, V. (eds.) 2004. Expertise finding: Approaches to foster social capital. Cambridge, MA; London: MIT Press.

Bera, R. & Claramunt, C. 2003. Topology-based proximities in spatial systems. Journal of Geographical Systems, 5, 353-379.

Berjleri, I. 2010. Using gis to analyze the role of barriers and facilitators to walking in children's travel to school. Urban Design International, 51-62.

Blaxter, M., Poland, F. & Curran, M. 2001. Measuring social capital: Qualitative study of how older people relate social capital to health. London: Health Development Agency.

Boarnet, M., Anderson, C., Day, K., Mcmillan, T. & Alfonzo, M. 2005. Evaluation of the california safe routes to school legislation: Urban form changes and children's active transportation to school. American Journal of Preventive Medicine, 28, 134-140.

Bonacich, P. 1987. Power and centrality: A family of measures. American Journal of Sociology, 1170-1182.

Bourdieu, P. 1985. The social space and the genesis of groups. Theory and Society, 14, 723-744.

Braza, M., Shoemaker, W. & Seeley, A. 2004. Neighborhood design and rates of walking and biking to elementary school in 34 california communities. American Journal of Health Promotion, 19, 128-136.

Brehm, J. & Rahn, W. 1997. Individual-level evidence for the causes and consequences of social capital. American Journal of Political Science, 999-1023.

Brown, T. A. 2006. Confirmatory Factor Analysis for Applied Research. New York, NY: The Guilford Press.

Buchanan, J. M. 1995. The limits of liberty: Between anarchy and leviathan, incollected works Indianapolis, IN: Liberty Press.

Cao, X. Y., Handy, S. L. & Mokhtarian, P. L. 2006. The influences of the built environment and residential self-selection on pedestrian behavior: Evidence from Austin, TX. Transportation, 33, 1-20.

Chaskin, R. J. 1995. Defining neighborhood: History, theory, and practice. A Chapin Hall Report. Chicago: The Chapin Hall Center for Children at the University of Chicago.

Chaskin, R. J. & Richman, H. A. 1992. Concerns about school-linked services: Institution-based versus community-based models. The Future of Children 2, 107-117.

Chaudhuri, B. B. 1996. A new definition of neighborhood of a point in multi-dimensional space. Pattern Recognition Letters, 17, 11-17.

Chavez, R., Kemp, L. & Harris, E. 2004. The social capital: Health relationship in two disadvantaged neighbourhoods. Journal of Health Services Research and Policy, 9, 29-34.

City of Austin. 2006. City of Austin Geographical Information System (GIS) data sets of 2003-2010. [Online] from: ftp://ftp.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html.

Claramunt, C. & Winter, S. 2007. Structural salience of elements of the city. Environment and Planning B: Planning and Design, 34, 1030-1050.

Clifton, K. J. & Kreamer-Fults, K. 2007. An examination of the environmental attributes associated with pedestrian-vehicular crashes near public schools. Accident Analysis and Prevention, 39, 708-715.

Colabianchi, N., Kinsella, A. E., Coulton, C. J. & Moore, S. M. 2009. Utilization and physical activity levels at renovated and unrenovated school playgrounds. Preventive Medicine, 48, 140-143.

Coleman, J. S. 1988. Social capital in the creation of human capital. The American Journal of Sociology, 94, 95-120.

Coleman, J. S. 1990. Foundations of social theory, Cambridge, MA: Belknap Press of Harvard University Press.

Comer, J. 1980. School power: Implications of an intervention project, New York, NY; London: Free Press.

Cooper, A. R., Andersen, L. B., Wedderkopp, N., Page, A. S. & Froberg, K. 2005. Physical activity levels of children who walk, cycle, or are driven to school. American Journal of Preventive Medicine, 29, 179-184.

Council of Educational Facilities Planners International (CEFPI). 2003. Acreage requirements and guidelines by States. Retrieved March 2010. [Online] from: http://www.cefpi.org/pdg/state_guidelines.doc.

Council of Educational Facilities Planners International (CEFPI) and U.S. Environmental Protection Agency (EPA). 2004. Schools for successful communities: An element of smart growth planning. Scottsdale, AZ: Council of Education Facility Planners International. Retrieved September 2010. [Online] from: http://www.epa.gov/dced/pdf/SmartGrowth_schools_Pub.pdf.

Couto, R. A. & Guthrie, C. S. 1999. Making democracy work better: Mediating structures, social capital, and the democratic prospect. Chapel Hill, NC: The University of North Carolina Press.

Crowson, R. L. 2001. Community development and school reform: An overview. Community development and school reform, 5, 1-18.

Crucitti, P., Latora, V. & Porta, S. 2006. Centrality measures in spatial networks of urban streets. Physical Review E, 73, 361251-361255.

Dalton, M. A., Longacre, M. R., Drake, K. M., Gibson, L., Adachi-Mejia, A. M., et al. 2011. Built environment predictors of active travel to school among rural adolescents. American Journal of Preventive Medicine, 40, 312-319.

Dannenberg, A. L., Jackson, R. J., Frumkin, H., Schieber, R. A., Pratt, M., et al. 2003. The impact of community design and land-use choices on public health: A scientific research agenda. American Journal of Public Health, 93, 1500-1508.

Davison, K., Cutting, T. & Birch, L. 2003. Parents' activity-related parenting practices predict girls' physical activity. Medicine and science in sports and exercise, 35, 1589-1595.

Davison, K. & Lawson, C. T. 2006. Do attributes in the physical environment influence children's physical activity? A review of the literature. International Journal of Behaviroal Nutrition and Physical Activity, 3, 1-17.

Dewey, J. 1898. Lectures on psychological and political ethics, New York, NY: Hafner Press.

Dillman, D. A. 2000. Mail and internet surveys: The tailored design method. New York, NY: John Wiley & Sons.

Driscoll, M. & Kerchner, C. 1999. The implications of social capital for schools, communities, and cities: Educational administration as if a sense of place mattered. Handbook of research in educational administration: A project of the American Educational Research Association, 385-402.

Driscoll, M. E. 2001. The sense of place and the neighborhood school : Implications for building social capital and for community development. In: L.Crowson, R. (ed.) Community development and school reform. Oxford, UK: Elsevier Science Ltd.

Edutation.com. 2011. Website. Retrieved March 2011. [Online] from: http://www.education.com.

Environmental Protection Agency (EPA). 2003. Travel and environmental iimplications of school sitting Washington, DC: U.S. Environmental Protection Agency.

Evenson, K. R., Huston, S. L., Mcmillen, B. J., Bors, P. & Ward, D. S. 2003. Statewide prevalence and correlates of walking and bicycling to school. Archives of Pediatrics & Adolescent Medicine, 157, 887-892.

Evenson, K. R. & Mcginn, A. P. 2005. Test-retest reliability of adult surveillance measures for physical activity and inactivity. American journal of preventive medicine, 28, 470-478.

Ewing, R. 2005. Can the physical environment determine physical activity levels? Exercise and Sport Sciences Reviews, 33, 69-75.

Ewing, R., Schroeer, W. & Greene, W. 2004. School location and student travel - analysis of factors affecting mode choice. Transportation Research Record: Journal of the Transportation Research Board, 1895, 55-63.

Farr, J. 2004. Social capital: A conceptual history. Political Theory, 32, 6-33.

Frank, L., Engelke, P. & Schmid, T. 2003. Health and community design: The impact of the built environment on physical activity Washington; Covelo; London, Island Press.

Frank, L. D. & Engelke, P. 2005. Multiple impacts of the built environment on public health: Walkable places and the exposure to air pollution. International Regional Science Review, 28, 193-216.

Frank, L. D., Schmid, T. L., Sallis, J. F., Chapman, J. & Saelens, B. E. 2005. Linking objectively measured physical activity with objectively measured urban form: Findings from SMARTRAQ. American Journal of Preventive Medicine, 28, 117-125.

Franzini, L., Caughy, M., Spears, W. & Esquer, M. E. F. 2005. Neighborhood economic conditions, social processes, and selfrated health in low-income neighborhoods in texas: A multilevel latent variables model. Social Science & Medicine, 61, 1135-1150.

Franzini, L., Elliott, M. N., Cuccaro, P., Schuster, M., Gilliland, M. J., et al. 2009. Influences of physical and social neighborhood environments on children's physical activity and obesity. American Journal of Public Health, 99, 271.

Franzini, L., Taylor, W., Elliott, M. N., Cuccaro, P., Tortolero, S. R., et al. 2010. Neighborhood characteristics favorable to outdoor physical activity: Disparities by socioeconomic and racial/ethnic composition. Health & Place, 16, 267-274.

Friedkin, N. E. 1991. Theoretical foundations for centrality measures. American Journal of Sociology, 1478-1504.

Fukuyama, F. 1995. Social capital and the global economy. Foreign Affairs, 89-103.

Fulton, J. E., Shisler, J. L., Yore, M. M. & Caspersen, C. J. 2005. Active transportation to school: Findings from a national survey. Research Quarterly for Exercise and Sport, 76, 352-357.

Fusco, G. C. 1964. School-home partnership in depressed urban neighborhoods. Washington, DC: U.S. Office of Educatio, Department of Health, Education, and Welfare

Gabbay, S. & Zuckerman, E. 1998. Social capital and opportunity in corporate r& d: The contingent effect of contact density on mobility expectations. Social Science Research, 27, 189-217.

Gibbs, G. 1992. Assessing more students, London, UK: Polytechnics and Colleges Funding Council.

Giles-Corti, B. & Donovan, R. 2003. Relative influences of individual, social environmental, and physical environmental correlates of walking. American Journal of Public Health, 93, 1583-1589.

Gilhooly, P. & Low, D. J. 2005. Primary school travel behaviour in midlothian, uk. Proceedings of the Institution of Civil Engineers-Municipal Engineer, 158, 129-136.

Green, G., Grimsley, M., Suokas, A., Prescott, M., Jowitt, T., et al. 2000. Social capital, health and economy in south yorkshire coalfield communities. Sheffield, UK: Sheffield Hallam University.

Greves, H. M., Lozano, P., Liu, L., Busby, K., Cole, J., et al. 2007. Immigrant families' perceptions on walking to school and school breakfast: A focus group study. International Journal of Behavioral Nutrition and Physical Activity, 4, 1-9.

Gurwitt, R. 2004. Edge-ucation: What compels communities to build schools in the middle of nowhere? Governing, 17, 22-26.

Hakim, A., Petrovitch, H., Burchfiel, C., Ross, G., Rodriguez, B., et al. 1998. Effects of walking on mortality among nonsmoking retired men. The New England Journal of Medicine, 338, 94-99.

Hall, P. A. 1999. Social capital in britain. British Journal of Political Science, 29, 417-461.

Halpern, D. 1999. Social capital: The new golden goose. Social and Political Sciences, Cambridge University Mimeo.

Hanifan, L. J. 1916. The rural school community center. The Annal of The American Academy of Political and Social Science, 67, 130-138.

Harper, R. 2001. Social capital: A review of the literature. Social Analysis and Reporting Division, Office for National Statistics, United Kingdom.

Harper, R. 2002. The measurement of social capital in the united kingdom. Office for National Statistics, United Kingdom.

Haynes, N. M. & Comer, J. P. 1996. Integrating schools, families, and communities through successful school reform: The school development program. School Psychology Review, 25, 501-506.

Hillier, B. & Hanson, J. 1984. The social logic of space, Cambridge, UK: Cambridge University Press.

Holtgrave, D. & Crosby, R. 2004. Social determinants of tuberculosis case rates in the united states. American Journal of Preventive Medicine, 26, 159-162.

Hume, C., Jorna, M., Arundell, L., Saunders, J., Crawford, D., et al. 2009. Are children's perceptions of neighbourhood social environments associated with their walking and physical activity? Journal of Science and Medicine in Sport, 12, 637-641.

Hume, C., Salmon, J. & Ball, K. 2005. Children's perceptions of their home and neighborhood environments, and their association with objectively measured physical activity: A qualitative and quantitative study. Health Education Research, 20, 1-13.

Inglehart, R. 1977. The silent revolution: Changing values and political styles among western publics, Princeton, NJ: Princeton University Press.

Jackson, L. 2003. The relationship of urban design to human health and condition. Landscape and Urban Planning, 64, 191-200.

Jacobs, J. 1961. The death and life of great american cities, NewYork, NY: Random House.

Kawachi, I., Kennedy, B., Lochner, K. & Prothrow-Stith, D. 1997. Social capital, income inequality, and mortality. American Journal of Public Health, 87, 1491.

Keating, W. & Krumholz, N. 2000. Neighborhood planning. Journal of Planning Education and Research, 20, 111.

Kennelly, B., O'shea, E. & Garvey, E. 2003. Social capital, life expectancy and mortality: A cross-national examination. Social Science & Medicine, 56, 2367-2377.

Kindred, L. W. 1957. School public relations. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Kindred, L. W., Bagin, D. & Gallagher, D. R. 1976. The school and community relations, Englewood Cliffs, NJ: Prentice-Hall, Inc.

King, A., Stokols, D., Talen, E., Brassington, G. & Killingsworth, R. 2002. Theoretical approaches to the promotion of physical activity forging a transdisciplinary paradigm. American Journal of Preventive Medicine, 23, 15-25.

Koniordos, S. M. 2008. Social capital contested. International Review of Sociology, 18, 317-337.

Kretzmann, J. & Mcknight, J. 1993. Building communities from the inside out: A path toward finding and mobilizing a community's assets, Chicago: ACTA Publications.

Kretzmann, J. & Mcknight, J. 1996. Assets-based community development. National Civic Review, 85, 23-29.

Larsen, K., Gilliland, J., Hess, P., Tucker, P., Irwin, J., et al. 2009. The influence of the physical environment and sociodemographic characteristics on children's mode of travel to and from school. American Journal of Public Health, 99, 520-526.

Lawhon, L. 2009. The neighborhood unit: Physical design or physical determinism? Journal of Planning History, 8, 111-132.

Leach, W. 1999. Country of exiles: The destruction of place in american life, New York, NY: Pantheon Books.

Leithwood, K. & Jantzi, D. 1999. The relative effects of principal and teacher sources of leadership on student engagement with school. Educational Administration Quarterly, 35, 679-706.

Levi, M. 1996. Social and unsocial capital: A review essay of robert putnam's making democracy work. Politics & Society, 24, 45-55.

Levin, P. 1966. The design process in planning: An exploratory study. The Town Planning Review, 5-20.

Leyden, K. M. 2003. Social capital and the built environment:The importance of walkable neighborhoods. American Journal of Public Health, 93, 1546-1551.

Lin, N. 1999. Building a network theory of social capital. Connections, 22, 28-51.

Lindstrom, M., Hanson, B. & Ostergren, P. 2001. Socioeconomic differences in leisure-time physical activity: The role of social participation and social capital in shaping health related behaviour. Social Science & Medicine, 52, 441-451.

Litwak, E. & Meyer, H. J. 1974. School, family and neighborhood: The theory and practice of school-community relations, New York; London: Columbia University Press.

Lochner, K., Kawachi, I., Brennan, R. & Buka, S. 2003. Social capital and neighborhood mortality rates in chicago. Social Science & Medicine, 56, 1797-1805.

Loury, G. 1992. Incentive effects of affirmative action. The ANNALS of the American Academy of Political and Social Science, 523, 19-29.

Maffeis, C., Talamini, G. & Tato, L. 1998. Influence of diet, physical activity and parents' obesity on children's adiposity: A four-year longitudinal study. International Journal of obesity, 22, 758-764.

Mcdonald, N. C. 2007. Active transport to school: Trends among us school children, 1969-2001. American Journal of Preventive Medicine, 32, 509-516.

Mcdonald, N. C. 2008a. Children's mode choice for the school trip: The role of distance and school location in walking to school. Transportation, 35, 23-35.

Mcdonald, N. C. 2008b. Critical factors for active transportation to school among low-income and minority students - evidence from the 2001 national household travel survey. American Journal of Preventive Medicine, 34, 341-344.

Mcdonald, N. C. 2010. School siting: Contested visions of the community school. Journal of the American Planning Association, 76, 184-198.

Mcdonald, N. C., Brown, A. L., Marchetti, L. M. & Pedroso, M. S. 2011. Us school travel, 2009:: An assessment of trends. American Journal of Preventive Medicine, 41, 146-151.

Mcknight, J. L. 1987. Regenerating community. Social Policy, 17, 54-58.

Mcmillan, T. 2007. The relative influence of urban form on a child's travel mode to school. Transportation Research Part A: Policy and Practice, 41, 69-79.

Mcmillan, T., Day, K., Boarnet, M., Alfonzo, M. & Anderson, C. 2006. Johnny walks to school - does jane? Sex differences in children's active travel to school. Children, Youth and Environments, 16, 75-89.

Mcneill, L., Kreuter, M. & Subramanian, S. 2006. Social environment and physical activity: A review of concepts and evidence. Social Science & Medicine, 63, 1011-1022.

Merom, D., Tudor-Locke, C., Bauman, A. & Rissel, C. 2006. Active commuting to school among nsw primary school children: Implications for public health. Health & Place, 12, 678-687.

Mitra, R., Building, R. N. & Roorda, M. J. 2010. Built environment and school travel mode choice in toronto, canada. Journal of the Transportation Research Board, 150-159.

Moehlman, A. B. & Van Zwoll, J. A. 1957. School public relations, New York, NY: Appleton-Century-Crofts.

Mota, J., Almeida, M., Santos, P. & Ribeiro, J. C. 2005. Perceived neighborhood environments and physical activity in adolescents. Preventive Medicine, 41, 834-836.

Mota, J., Gomes, H., Almeida, M., Ribeiro, J. C., Carvalho, J., et al. 2007. Active versus passive transportation to school - differences in screen time, socio-economic position and perceived environmental characteristics in adolescent girls. Annals of Human Biology, 34, 273-282.

Napier, M. A. 2010. Walking to school: Community design and child and parent barriers. Journal of Environmental Psychology, 31, 45-51.

National Trust for Historic Preservation. 2008. Checklist: Is your school a community-centered school? Retrieved March 2010. [Online] from: http://www.preservationnation.org/issues/historic-schools/helping-johnny-walk-to-school/checklist.html.

Navarro, V. 2002. A critique of social capital. International Journal of Health Services, 32, 423-432.

Nelson, N. M., Foley, E., O'gorman, D. J., Moyna, N. M. & Woods, C. B. 2008. Active commuting to school: How far is too far? International Journal of Behavioral Nutrition and Physical Activity, 5, 1-9.

Ogden, C., Flegal, K., Carroll, M. & Johnson, C. 2002. Prevalence and trends in overweight among us children and adolescents, 1999-2000. The Journal of American Medical Association, 288, 1728-1732.

Onyx, J. & Bullen, P. 2000. Measuring social capital in five communities. The Journal of Applied Behavioral Science, 36, 23-42.

Osterman, K. F. 2000. Students' need for belonging in the school community. Review of Educational Research, 70, 323-367.

Panter, J. R., Jones, A. P., Sluijs, E. M. F. & Griffin, S. J. 2009. Attitudes, social support and environmental perceptions as predictors of active commuting behaviour in school children. Journal of Epidemiol Community Health, 64, 41-48.

Panter, J. R., Jones, A. P., Van Sluijs, E. M. F. & Griffin, S. J. 2010. Neighborhood, route, and school environments and children's active commuting. American Journal of Preventive Medicine, 38, 268-278.

Passmore, S. 2002. Education and smart growth: Reversing school sprawl for better schools and communities. Miami, Florida: Funder's Network for Smart Growth and Livable Communities.

Perry, C. 1925. The report of committee. The Committee on School House Planning of the National Education Association.

Perry, C. 1929 The neighborhood unit: A scheme of arrangement for the family-life community. Regional Plan for New York and Its Environs VIII, neighborhood and community planning, Monograph 1. New York.

Pollack, C. & Von Dem Knesebeck, O. 2004. Social capital and health among the aged: Comparisons between the United States and Germany. Health & Place, 10, 383-391.

Popkewitz, T. S. 1998. Dewey, vygotsky, and the social administration of the individual: Constructivist pedagogy as systems of ideas in historical spaces. American Educational Research Journal, 35, 535-570.

Portes, A. 1998. Social capital: Its origins and applications in modern sociology. Annual Review of Sociology, 24, 1-24.

Preacher, K. J. & Hayes, A. F. 2004. Spss and sas procedures for estimating indirect effects in simple mediation models. Behavior Research Methods, 36, 717-731.

Preacher, K. J. & Hayes, A. F. 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods, 40, 879-891.

Putnam, R. D. 1993. The prosperous community: Social capital and public life. American Prospect, 13, 35-42.

Putnam, R. D. 1995. Bowling alone: America's declining social capital. Journal of Democracy 6, 65-78.

Putnam, R. D. 2000. Bowling alone: The collapse and revival of american community, New York, NY: Simon & Schuster.

Putnam, R. D. 2001. Social capital: Measurement and consequences. Canadian Journal of Policy Research, 2, 41-51.

Putzel, J. 1997. Policy arena: Accounting for the 'dark side'of social capital: Reading robert putnam on democracy. Journal of International Development, 9, 939-949.

Ramsey, C. & Sleeper, H. 1994. AIA architectural graphic standards, 9th edition. New York, NY: John Wiley and Sons.

Robertson-Wilson, J. E., Leatherdale, S. T. & Wong, S. L. 2008. Social-ecological correlates of active commuting to school among high school students. Journal of Adolescent Health, 42, 486-495.

Rodriguez, A. & Vogt, C. A. 2009. Demographic, environmental, access, and attitude factors that influencewalking to schoolbyelementaryschool-agedchildren. Journal of School Health, 79, 255-261.

Roemmich, J., Epstein, L., Raja, S., Yin, L., Robinson, J., et al. 2006. Association of access to parks and recreational facilities with the physical activity of young children. Preventive Medicine, 43, 437-441.

Sallis, J., Cervero, R., Ascher, W., Henderson, K., Kraft, M., et al. 2006. An ecological approach to creating active living communities. Annual Review of Public Health, 27, 297-322.

Sallis, J., Conway, T., Prochaska, J., Mckenzie, T., Marshall, S., et al. 2001. The association of school environments with youth physical activity. American Journal of Public Health, 91, 618.

Sallis, J. & Glanz, K. 2006. The role of built environments in physical activity, eating, and obesity in childhood. The Future of Children, 16, 89-108.

Sallis, J., Prochaska, J. & Taylor, W. 2000. A review of correlates of physical activity of children and adolescents. Medicine & Science in Sports & Exercise, 32, 963.

Salmon, J., Salmon, L., Crawford, D. A., Hume, C. & Timperio, A. 2007. Associations among individual, social, and environmental barriers and children's walking or cycling to school. American Journal of Health Promotion, 22, 107-113.

Schiff, M. 1992. Social capital, labor mobility, and welfare: The impact of uniting states. Rationality and Society, 4, 157-175.

Schlossberg, M., Greene, J., Phillips, P. P., Johnson, B. & Parker, B. 2006a. School trips - effects of urban form and distance on travel mode. Journal of the American Planning Association, 72, 337-346.

Schlossberg, M., Greene, J., Phillips, P. P., Johnson, B. & Parker, B. 2006b. School trips: Effects of urban form and distance on travel mode. Journal of the American Planning Association, 72, 337-346.

School Choice For Kids by Independence Institute. 2011. Website. Retrieved March 2011. [Online] from: http://www.schoolchoiceforkids.org/english.php?ID=24.

Schorr, L. 1997. Common purpose: Strengthening families and, neighborhoods to rebuild America. New York, NY: Anchor Books/Doubleday.

Schuller, T., Baron, S. & Field, J. 2000. Social capital: A review and critique. In: Baron, S. (ed.) Social Capital: Critical Perspectives. Oxford, UK; New York, NY: Oxford University Press Inc.

Schumpeter, J. A. 1934. The theory of economic development. Cambridge, MA: Harvard University Press.

Schwirian, K. P. 1983. Models of neighborhood change. Annual Review of Sociology, 9, 83-102.

Seeley, J. R., Sim, A. & Elizabethw.Loosley 1956. Crestwood heights: A study of the culture of suburban life, New York, NY: Basic Books.

Sharp, M. 2008. Local governments and schools: A community-oriented approach. IQ Report. Washington, DC: International City/County Management Association.

Silver, C. 1985. Neighborhood planning in historical perspective. Journal of the American Planning Association, 51, 161-174.

Skrabski, A., Kopp, M. & Kawachi, I. 2003. Social capital in a changing society: Cross sectional associations with middle aged female and male mortality rates. British Medical Journal, 57, 114-119.

Smrekar, C. E. & Mawhinney, H. B. 1999. Integrated services: Challenges in linking schools, families, and communities. Handbook of research on educational administration, 2, 443-461.

Smylie, M. A., Crowson, R. L., Chou, V. & Levin, R. A. 1994. The principal and community-school connections in chicago's radical reform. Educational Administration Quarterly, 30, 342-364.

Sobel, J. 2002. Can we trust social capital? Journal of Economic Literature, 40, 139-154.

Sobel, M. E. 1982. Asymptotic confidence intervals for indirect effects in structural equation models. Sociological Methodology, 13, 290-312.

Sobel, M. E. 1987. Direct and indirect effects in linear structural equation models. Sociological Methods & Research, 16, 155.

Soper, D. 2009. Sobel test calculator for the significance of mediation: Free statistics calculators website [Online]. from: http://www.danielsoper.com/statcalc/calc31.aspx.

Spellerberg, A. 1997. Towards a framework for the measurement of social capital in robinson, Research and Analytical Report. Wellington, New Zealand: Statistics New Zealand Te Tari Tatau.

Stedman, R. 2003. Is it really just a social construction?: The contribution of the physical environment to sense of place. Society & Natural Resources, 16, 671-685.

Subramanian, S., Kim, D. & Kawachi, I. 2002. Social trust and self-rated health in us communities: A multilevel analysis. Journal of Urban Health, 79, 21-34.

Subramanian, S. V., Lochner, K. A. & Kawachi, I. 2003. Neighborhood differences in social capital: A compositional artifact or a contextual construct? Health and Place, 9, 33-44.

Sun, Y. 1999. The contextual effects of community social capital on academic performance* 1. Social Science Research, 28, 403-426.

Szreter, S. & Woolcock, M. 2004. Health by association? Social capital, social theory, and the political economy of public health. International Journal of Epidemiology, 33, 650-667.

Texas Education Agency (TEA). 2011. 2009-2010 Academic Excellence Indicator System. Retrieved March 2011, [Online] from: http://www.tea.state.tx.us/perfreport/aeis/2010/index.html.

Thompson, O. & Tom, F. 1957. Comparison of the effectiveness of a pupil-centered versus a teacher-centered pattern for teaching vocational agriculture. The Journal of Educational Research, 667-678.

Timperio, A., Ball, K., Salmon, J., Roberts, R., Giles-Corti, B., et al. 2006. Personal, family, social, and environmental correlates of active commuting to school. American Journal of Preventive Medicine, 30, 45-51.

Tomko, M., Winter, S. & Claramunt, C. 2008. Experiential hierarchies of streets. Computers, Environment and Urban Systems, 32, 41-52.

Trochim, W. M. K. 2006. The research methods knowledge base [Online]. from: http://www.socialresearchmethods.net/kb/index.php.

Tversky, B. 1993. Cognitive maps, cognitive collages, and spatial mental models. Spatial Information Theory A Theoretical Basis for GIS, 14-24.

Ulfarsson, G. F. & Shankar, V. N. 2008. Children's travel to school: Discrete choice modeling of correlated motorized and nonmotorized transportation modes using covariance heterogeneity. Environment and Planning B-Planning & Design, 35, 195-206.

Uzzi, B. 1997. Social structure and competition in interfirm networks: The paradox of embeddedness. Administrative Science Quarterly, 42, 35-67.

Veenstra, G., Luginaah, I., Wakefield, S., Birch, S., Eyles, J., et al. 2005. Who you know, where you live: Social capital, neighbourhood and health. Social Science & Medicine, 60, 2799-2818.

Vincent, J. M. 2006. Public schools as public infrastructure : Roles for planning researchers. Journal of Planning Education and Research, 25, 433-437.

Walker, G., Kogut, B. & Shan, W. 1997. Social capital, structural holes and the formation of an industry network. Organization Science, 8, 109-125.

Wasserman, S. & Faust, K. 1994. Social network analysis: Methods and applications, Cambridge, UK: Cambridge University Press.

Weitzman, E. & Kawachi, I. 2000. Giving means receiving: The protective effect of social capital on binge drinking on college campuses. American Journal of Public Health, 90, 1936-1939.

Wen, M., Browning, C. R. & Cagney, K. A. 2003. Poverty, affluence, and income inequality: Neighborhood economic structure and its implications for health. Social Science & Medicine, 57, 843-860.

Woolcock, M. 1988. Social capital and economic development: Toward a theoretical synthesis and policy framework. Theory and Society, 27, 151-208.

Yarlagadda, A. K. & Srinivasan, S. 2008. Modeling children's school travel mode and parental escort decisions. Transportation, 35, 201-218.

Yelavich, S., Towns, C., Burt, R., Chow, K., Donohue, R., et al. 2008. Walking to school: Frequency and predictors among primary school children in dunedin, new zealand. The New Zealand Medical Journal, 121, 51-58.

Yeung, J., Wearing, S. & Hills, A. P. 2008. Child transport practices and perceived barriers in active commuting to school. Transportation Research Part a-Policy and Practice, 42, 895-900.

Zhu, X. 2009. Community environments and walking-to-school behaviors: Multi-level correlates and underlying disparities. Dissertation. Texas A&M University.

Zhu, X. & Lee, C. 2008a. Correlates of walking-to-school behaviros and implicaitons for public policies. Washington, DC: Active Living Research 2008 Annual Conference.

Zhu, X. & Lee, C. 2008b. Ethnic disparity in the multi-level walkability and safety of public elementary school's attendance areas. American Jounal of Preventive Medicine, 34, 282-290.

Zhu, X. & Lee, C. 2009. Correlates of walking to school and implications for public policies: Survey results from parents of elementary school children. Journal of Public Health Policy, 30, 177-202.

Ziersch, A., Baum, F., Macdougall, C. & Putland, C. 2005. Neighbourhood life and social capital: The implications for health. Social Science & Medicine, 60, 71-86.

Ziviani, J., Scott, J. & Wadley, D. 2004. Walking to school: Incidental physical activity in the daily occupations of australian chidlren. Occupational Therapy International, 11, 1-11.

APPENDIX A

SAFE ROUTES TO SCHOOL SURVEY INSTRUMENT

TODAY'S DATE: ___ / ___ / ____ (Month) (Day) (Year)

SAFE ROUTES TO SCHOOL SURVEY

Directions: This survey is to be answered by the parent/guardian who is **most involved in getting the child to and from school.** Everything you tell us will be kept strictly confidential (secret).

The following questions are about how your child normally travels to and from school.

	From home to school	From school to home
1. On a normal day, how does your child travel? (Please answer BOTH columns on right.)	☐ Walk *alone* ☐ Walk *with friends* ☐ Walk *with a parent/adult* ☐ Bike ☐ School bus ☐ Public bus or light rail ☐ Private car, including carpool	☐ Walk *alone* ☐ Walk *with friends* ☐ Walk *with a parent/adult* ☐ Bike ☐ School bus ☐ Public bus or light rail ☐ Private car, including carpool

2. At what grade would/did you allow your child to walk or bike without an adult to/from school?
Grade (K-6): _____ (or ☐ I would not feel comfortable at any grade)

3. How long does it take to get to school? _____ Minutes

4. Is this distance close enough for your child to walk to school? ☐ Yes ☐ No

5. Does the school provide bus service for your child? ☐ Yes ☐ No

6. Have you volunteered at your child's school (e.g. PTA, PTO, SHAC, library, cafeteria monitor, classroom assistant) in the past 12 months? ☐ Yes ☐ No

Now we would like to ask you some questions about your child's way to and from school.

7. Which of the following are located along your child's way to school? (Check all that apply.)

☐ Playground	☐ Park	☐ Walking path/trail	☐ Convenience store
☐ Bakery/café/restaurant	☐ Small retail/business	☐ Bus stop	☐ Community/youth center
☐ Large parking lot/garage	☐ Large office building	☐ Industrial site/junk yard	☐ Vacant lot
☐ Gas station	☐ Others: _____		☐ None of the above

8. Which of the following would your child have to cross if he/she walks to school? (Check all that apply.)

☐ Highway or freeway	☐ Road with busy traffic	☐ Intersection without street signals or stop signs
☐ Intersection without a painted crosswalk	☐ Railway/light rail	☐ None of the above

9. Are there sidewalks along your child's way to school?

☐ Yes, on all streets ☐ Yes, on most streets ☐ Yes, on some streets ☐ Yes, on very few streets

☐ No → *Skip the next question and go to* ***question 11.***

10. What do you think about the sidewalks along your child's way to and from school? Please tell us how much you agree or disagree with each statement by checking your answers?	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
1) Sidewalks are well maintained and clean.	☐	☐	☐	☐	☐
2) Sidewalks are wide enough for two persons walking together.	☐	☐	☐	☐	☐
3) Sidewalks are separated from traffic by grass or trees.	☐	☐	☐	☐	☐
4) Sidewalks are free of obstructions (e.g. trash cans, power poles, or parked cars).	☐	☐	☐	☐	☐

11. What do you think about the overall walking environment (including sidewalks [if available], roads, and buildings)?	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
1) It is convenient to walk to school.	☐	☐	☐	☐	☐
2) It is well maintained and clean.	☐	☐	☐	☐	☐
3) It is well shaded by trees.	☐	☐	☐	☐	☐
4) It is quiet (without much noise from cars, airplanes, factories, etc.).	☐	☐	☐	☐	☐

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5) There are nice things to see.	☐	☐	☐	☐	☐
6) Streets are well lit.	☐	☐	☐	☐	☐
7) The school zones are well enforced.	☐	☐	☐	☐	☐
12. How about safety concerns about walking to school? 	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
1) My child may get lost.	☐	☐	☐	☐	☐
2) My child may be taken or hurt by a stranger.	☐	☐	☐	☐	☐
3) My child may get bullied, teased, or harassed.	☐	☐	☐	☐	☐
4) My child may be attacked by stray dogs.	☐	☐	☐	☐	☐
5) My child may be hit by a car.	☐	☐	☐	☐	☐
6) Exhaust fumes may harm my child's health.	☐	☐	☐	☐	☐
7) No one will be able to see and help my child in case of danger.	☐	☐	☐	☐	☐
8) My child may get injured by falling (due to drainage ditch, uneven walking surface, etc.).	☐	☐	☐	☐	☐

13. How do you feel about walking and your neighborhood? 	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
1) Walking to school involves too much planning ahead.	☐	☐	☐	☐	☐
2) It's easier/faster for me to drive my child to/from school.	☐	☐	☐	☐	☐
3) My child has too much to carry.	☐	☐	☐	☐	☐
4) My child gets too hot and sweaty.	☐	☐	☐	☐	☐
5) My child thinks walking to school is "cool".	☐	☐	☐	☐	☐
6) My child walks quite often in his/her daily routine.	☐	☐	☐	☐	☐
7) Walking is a good way to exercise.	☐	☐	☐	☐	☐
8) Walking is a good way to interact with other people.	☐	☐	☐	☐	☐
9) I walk quite often in my daily routine.	☐	☐	☐	☐	☐
10) I (would) enjoy walking with my child to/from school.	☐	☐	☐	☐	☐
11) My family and friends like the idea of walking to school.	☐	☐	☐	☐	☐
12) Other kids walk to/from school in my neighborhood.	☐	☐	☐	☐	☐
13) Other kids and parents walk quite often in their daily routines.	☐	☐	☐	☐	☐
14) I feel connected to people in my neighborhood.	☐	☐	☐	☐	☐

14. If your child does not walk to school, how likely would it be that you would allow your child to walk to and from school if:	Very unlikely	Somewhat unlikely	Neither unlikely nor likely	Somewhat likely	Very likely
1) ... there were good sidewalks?	☐	☐	☐	☐	☐
2) ... the neighborhood was safer?	☐	☐	☐	☐	☐
3) ... the school was closer to home?	☐	☐	☐	☐	☐
4) ... you or an adult you knew could walk with the child?	☐	☐	☐	☐	☐
5) ... other children in the neighborhood walked to school?	☐	☐	☐	☐	☐
6) ... there were more crossing guards along the route?	☐	☐	☐	☐	☐
7) ... the speed of traffic along the route was slower?	☐	☐	☐	☐	☐
8) ... the amount of traffic along the route was less?	☐	☐	☐	☐	☐

15. About the Child Who Brought the Survey Home

1) Child is: ☐ Male ☐ Female

2) Child's grade: _____

3) Child's weight: _____ pounds OR _____ kg (kilograms)

4) Child's height: _____ feet _____ inches OR _____ meters

5) Is your child: ☐ Hispanic ☐ White, Non-Hispanic ☐ African American ☐ Other: _____

6) Does your child have any of the following health conditions? (Check all that apply.)
☐ Diabetes ☐ Obesity ☐ Hypertension ☐ Heart condition ☐ Asthma
☐ Depression ☐ ADHD ☐ Autism ☐ None of the above ☐ Others: _____

7) During a usual WEEK, how many days does your child take part in physical activity for at least 60 minutes?
_____ Days / WEEK

8) During a usual WEEKDAY, how many minutes does your child spend watching television, using a computer, reading, or playing video games, when not working/studying?
_____ Minutes / WEEKDAY

9) During a usual WEEKDAY, how many minutes does your child play outdoors? (Do NOT count outdoor play during school hours.)
_____ Minutes / WEEKDAY

10) Where does your child play outside <u>at least once a week</u>?
☐ School ☐ Park/playground ☐ Yards at home ☐ Neighborhood streets ☐ Friend's house ☐ Others: _____

11) Does your child qualify for special school lunch programs? ☐ Yes, free lunch ☐ Yes, reduced price lunch ☐ No

16. About Family Members

1) What is your relationship to the child you are completing this survey for?
☐ Mother ☐ Father ☐ Grandmother ☐ Grandfather ☐ Other: _____

2) Are you: ☐ Hispanic ☐ White, Non-Hispanic ☐ African American ☐ Other: _____

3) Were you born in the US? ☐ Yes ☐ No

4) Which adults (relationship to the child) live with the child in the household? (Check all that apply including yourself.)
☐ Mother ☐ Father ☐ Grandmother ☐ Grandfather ☐ Other: _____

5) Are any of those adults available to walk your child to/from school? ☐ Yes ☐ No

6) What is the highest level of education completed among all adults (including yourself) in your household?
☐ Elementary or less ☐ Middle school
☐ High school or GED ☐ Some college/Associate degree
☐ College graduate/Bachelor's degree ☐ Graduate/professional degree

7) What are the ages of all children in your household? ____ ; ____ ; ____ ; ____ ; ____ ; ____ ; ____

8) What language do you use most often at home? ☐ English ☐ Spanish ☐ Others: _____

17. About Your Household

1) Your home address: _____, Austin, TX, ZIP | | | | | |

2) How long have you lived in your current residence? _____ Years

3) What's your main reason to choose this neighborhood? (Check all that apply.)
☐ Housing price ☐ Close to work ☐ Close to my child's school ☐ Quality of school
☐ Quality of neighborhood ☐ Easy to walk around ☐ Others: _____ ☐ None of the above

4) Does your family have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?
☐ Yes, everyone ☐ Yes, only the adult(s) ☐ Yes, only my child(ren) ☐ No, no one has coverage

5) Was there a time in the past 12 months when your child needed to see a doctor but could not because of cost?
☐ Yes ☐ No

6) How many cars are there in your household? _____ Cars

7) How many people in your household have a driver's license? _____ People

8) How many times per month does your household buy groceries? _____ Times/MONTH

9) Do you have any pets in your household? ☐ None ☐ Dog(s) ☐ Cat(s) ☐ Others: _____

10) Is your annual household income from all sources: (☐ don't know/not sure ☐ don't want to answer)

☐ less than $5,000 ☐ $5,000 - $9,999 ☐ $10,000 - $19,999 ☐ $20,000 - $39,999
☐ $40,000 - $59,999 ☐ $60,000 - $79,999 ☐ $80,000 - $99,999 ☐ $100,000 or more

The following questions ask about changes and activities in the past year.

18. Are you expecting that your child may transfer to another elementary school in the near future?

☐ Yes → 1) To which school? ☐ don't know/not sure _____ Elementary School
2) When? ☐ don't know/not sure Year: ____ ☐ Fall ☐ Spring
☐ No

19. In the past year, did any of the following take place in your child's school or in your neighborhood? (Check all that apply.)

☐ Walking to school month/day
☐ Media message promoting walking/biking to school
☐ Pedestrian safety education
☐ Crimes that involved school children
☐ Traffic accidents that involved school children
☐ None of the above

20. In the past year, did any of the following environmental changes take place along your child's way to/from school? (Check all that apply from BOTH columns.)

Positive changes: *new or improvements on:*

☐ Sidewalks ☐ Walking paths or trails
☐ Crosswalks ☐ Bike lanes ☐ Playgrounds
☐ Parks ☐ Trees/shade ☐ Drainage
☐ Traffic calming devices (e.g. speed bumps)
☐ Signage (e.g. school zone, child crossing warning)
☐ Others: _____
☐ None of the above

Negative changes:

☐ Construction activities
☐ Development of a large parking lot or garage
☐ Development of industrial sites or junk yards
☐ Appearance of vacant lots
☐ Increase in traffic ☐ volume and/or ☐ speed
☐ Others: _____
☐ None of the above

21. Which do you think is the center of your neighborhood?

☐ Your child's elementary school
☐ Middle or high school
☐ Government / civic facility
☐ Transit / bus stop
☐ Park
☐ Other elementary school
☐ Office / office complex
☐ Shopping center / other commercial facilities
☐ Public plaza / performance space (not park)
☐ Others: _____

THANK YOU FOR YOUR HELP!

Our efforts are devoted to creating safe and healthy environments for children and families. Would you be interested in helping us by letting us contact you for similar studies or activities in the future?

☐ Yes (Please provide your contact information below. You can withdraw at any time in the future.)
☐ No

Your name (optional): _____ Phone number ___ - ___ - ____

E-mail (optional): _____

63034

APPENDIX B

PARENTAL SOCIAL CAPITAL SURVEY INSTRUMENT:

TELEPHONE SURVEY AND E-MAIL SURVEY SCRIPT

Telephone Survey Script

PARENTAL SOCIAL CAPITAL SURVEY

Scripts:

"Hello, I'm calling from a Texas A&M University research team. Is this [telephone number]?"

→ If no, redial more carefully **[If yes, continue]**

"Hi, my name is [interviewer's name] and [interviewer's brief information (e.g., a master student in Landscape Architecture)]. First of all, I'd like to thank you for your participation in our Safety Routes To School Survey last year, and also for indicating in that survey that it is okay for our research team to contact you for relevant future studies. We are now conducting a short follow-up phone interview about your neighborhood focusing on the social factors. If you agree to participate, you will be asked to answer 11 questions, mostly by choosing numbers or "Yes/"No" and it will take only 5 minutes. The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in daily life. You will receive no direct benefit from participating in this study; however, findings of this study will help improve your social/physical environment to be a health-promoting neighborhood. Also, upon completion, you will be entered into a drawing to win a $100 gift card. Are you interested in participating in this interview?"

→ If no, "*That is okay. Thank you for your time. Have a good day.*" **[If yes, continue]**

"Great, This survey will help us better understand your neighborhood environments in terms of its social activities. This study is being funded by Robert Wood Johnson Foundation. Your answer will be used solely for the research purposes, and the records will be kept confidential. After you complete the survey, No identifiers linking you to this study will be included in any sort of report that might be published. Your participation is voluntary. You may decide not to participate or to withdraw at any time without your current or future relations with Texas A&M University being affected. Also, You can skip any question if you do not want to answer, and you may stop answering questions at any time. Do you fully understand information?"

→ If they don't want to participate, "*That is okay. Thank you for your time. Have a good day.*"
→ If they need further information, "*Sure, if you want, we can send you an information document. Could you give us any email address or home address to get this information?*"
→ **[If yes, continue]**

"Now, I will start with the questions." **[Next Page]**

Telephone Survey Script

Questions:

*"The following 6 questions are about your social feelings in your neighborhood. Please choose a number of ratings from 1 to 5. **1** is very unlikely, **2** is unlikely, **3** is neither unlikely nor likely, 4 is likely, and **5** is very likely."*

		Very Unlikely(1)				Very Likely(5)
1.	Do you feel that most people in your neighborhood can be trusted?	1	2	3	4	5
2.	Do you feel that most people in your neighborhood are honest?	1	2	3	4	5
3.	Do you feel close to other people in your neighborhood?	1	2	3	4	5
4.	Do you feel that you belong in your neighborhood?	1	2	3	4	5
5.	Do you often visit your neighbors?	1	2	3	4	5
6.	Do you attend church or other religious institutions regularly?	1	2	3	4	5

"The following 5 questions are about your social activities in your neighborhood. Please choose "yes" or "no" or give us an "approximation number" for the each question".

7.	In the past 12 months, have you voted in an election?	❑ Yes (1)	❑ No (0)
8.	In the past 12 months, have you served for any community organization?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how many times did you volunteer?	About ( ) times ❑ Don't remember (77)	
9.	In the past 12 months, have you attended a meeting of a school board?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how many times did you attend it?	About ( ) times ❑ Don't remember (77)	
10.	In the past 12 months, have you volunteered for your child's school affair?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how many times did you attend it?	About ( ) times ❑ Don't remember (77)	
11.	Have you used your child's school facility (e.g., school ground, jogging track, etc.) for your recreational purposes?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how often do you use per month?	About ( ) times ❑ Don't remember (77)	

"You're finished! If you have any questions about this research, please contact Hyung Jin Kim at 979-739-1405 or kimhj@tamu.edu. Also, This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at 979-458-4067 or irb@tamu.edu. Thank you for your time and effort."

Email Survey Template [Mar 29, 2011]

PARENTAL SOCIAL CAPITAL SURVEY

Dear Parents,

First of all, I'd like to thank you for your participating in our ***Safety Routes To School Survey*** last year, and also for indicating in that survey that it is okay for our research team to contact you for relevant future studies. We are now conducting a short follow-up email survey about your neighborhood focusing on the social factors.

This follow-up **Parental Social Capital Survey** is being funded by the Robert Wood Johnson Foundation and conducted by a research team from Texas A&M University. If you agree to participate, you will be asked to answer 11 questions which will take no more than 5 minutes. Upon completion, you will be entered into a drawing to win a $100 gift card.

It is for research purpose only. There is no risk in answering this survey. After you complete the survey, all your personal information will be removed and kept confidential. Only an ID number will be used to identify you and your child. Also, the information collected is private and will be kept in a secure location. It will be available only to a few researchers. At the end of the project, it will be destroyed. You can skip a question if you do not want to answer it, and you may stop answering questions at any time or stop taking part in this survey.

Your assistance in our research would be of great value to us. If you have any questions, please contact me via phone or call. Thank you in advance for your consideration.

Sincerely,

Hyung Jin Kim
Ph.D. Candidate
Department of Landscape Architecture and Urban Planning
Texas A&M University
979-739-1405 / kimhj@tamu.edu

If you are interested in participating in this survey, please click the start button
[if "click" the start button, continue to the next page →]

Email Survey Template [Mar 29, 2011]

INFORMATION SHEET

[School-Community Relations, Social Capital, and Children's Physical Activity]

Introduction

The purpose of this form is to provide you (as a prospective research study participant) information that may affect your decision as to whether or not to participate in this research.

You have been asked to participate in a research study on the parental social environment and social activity, and how it affects your child's physical activity. The purpose of this study is to seek a better understanding about your social environments and social activities that might promote your child's physical activity. You were selected to be a possible participant because you allowed us to contact you for the future study in the previous *Safe Routes To School Survey* conducted by a research team from Texas A&M University in 2010. This study is being funded by Robert Wood Johnson Foundation.

What will I be asked to do?

If you agree to participate in this study, you will be asked to answer about 11 questions about your social environments and social activities, mostly by choosing numbers or "Yes/No". This study will take less than 5 minutes.

What are the risks involved in this study?

The risks associated with this study are minimal, and are not greater than risks ordinarily encountered in daily life.

What are the possible benefits of this study?

You will receive no direct benefit from participating in this study; however, findings of this study will help improve your social/physical environment to be a health-promoting neighborhood.

Do I have to participate?

No. Your participation is voluntary. You may decide not to participate or to withdraw at any time without your current or future relations with Texas A&M University being affected.

Who will know about my participation in this research study?

This study is confidential and the records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only a few researchers will access to the records.

Whom do I contact with questions about the research?

If you have questions regarding this study, you may contact Hyung Jin Kim (979-739-1405, kimhj@neo.tamu.edu) or Chanam Lee, Ph.D. (979-845-7056, clee@archmail.tamu.edu).

Whom do I contact about my rights as a research participant?

This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at (979)458-4067 or irb@tamu.edu.

I have read and understand the above information. [if click "YES" button, continue to the next page →]

Email Survey Template [Mar 29, 2011]

PARENTAL SOCIAL CAPITAL SURVEY

"The following 6 questions are about your social feelings in your neighborhood. Please **choose a number of ratings from 1 to 5**.

(Note: 1:Very Unlikely, 2:Unlikely, 3: Neither unlikely nor likely, 4:Llikely 5:Very Likely.)

		Very Unlikely(1)				*Very Likely(5)*
1.	Do you feel that most people in your neighborhood can be trusted?	**1**	**2**	**3**	**4**	**5**
2.	Do you feel that most people in your neighborhood are honest?	**1**	**2**	**3**	**4**	**5**
3.	Do you feel close to other people in your neighborhood?	**1**	**2**	**3**	**4**	**5**
4.	Do you feel that you belong in your neighborhood?	**1**	**2**	**3**	**4**	**5**
5.	Do you often visit your neighbors?	**1**	**2**	**3**	**4**	**5**
6.	Do you attend church or other religious institutions regularly?	**1**	**2**	**3**	**4**	**5**

"The following 5 questions are about your social activities in your neighborhood. Please choose "yes" or "no" or give us an "approximation number" for the each question".

7.	In the past 12 months, have you voted in an election?	❑ Yes (1)	❑ No (0)
8.	In the past 12 months, have you served for any community organization?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how many times did you volunteer?	About ( ) times ❑ Don't remember (77)	
9.	In the past 12 months, have you attended a meeting of a school board?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how many times did you attend it?	About ( ) times ❑ Don't remember (77)	
10.	In the past 12 months, have you volunteered for your child's school affair?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how many times did you attend it?	About ( ) times ❑ Don't remember (77)	
11.	Have you used your child's school facility (e.g., school ground, jogging track, etc.) for your recreational purposes?	❑ Yes (1)	❑ No (0)
	If yes → Could you tell me how often do you use per month?	About ( ) times ❑ Don't remember (77)	

You're finished! THANK YOU for your time and effort!

VITA

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M.L.A., Urban Design, Seoul National University, Korea, 2002
Ph.D., Urban and Regional Science, Texas A&M University, 2011

Work Experience: Assistant Research Fellow, Korea Research Institute for Human Settlements (KRIHS), 2002-2006
Associate Research Fellow, Korea Research Institute for Human Settlements (KRIHS), 2006-2007

Selected Awards: Urban and Regional Science Doctoral Departmental Scholarship, $1,000, Texas A&M University, 2009
Jesus Hinojosa Endowed Urban Planning Scholarship, $1,000, Texas A&M University, 2008
Active Living Research Program Dissertation Grant, $24,680, Robert Wood Johnson Foundation, 2011